

University of Alberta

Identifying and Predicting Chronic Care Need in the Inuvik Region,
Northwest Territories

by

Maria Mathews



A thesis submitted to the Faculty of Graduate Studies and Research in partial
fulfilment of the requirements for the degree of Master of Health Services
Administration

Department of Public Health Sciences

Edmonton, Alberta

Fall, 1996



National Library
of Canada

Acquisitions and
Bibliographic Services Branch

395 Wellington Street
Ottawa, Ontario
K1A 0N4

Bibliothèque nationale
du Canada

Direction des acquisitions et
des services bibliographiques

395, rue Wellington
Ottawa (Ontario)
K1A 0N4

Your file *Votre référence*

Our file *Notre référence*

The author has granted an irrevocable non-exclusive licence allowing the National Library of Canada to reproduce, loan, distribute or sell copies of his/her thesis by any means and in any form or format, making this thesis available to interested persons.

L'auteur a accordé une licence irrévocable et non exclusive permettant à la Bibliothèque nationale du Canada de reproduire, prêter, distribuer ou vendre des copies de sa thèse de quelque manière et sous quelque forme que ce soit pour mettre des exemplaires de cette thèse à la disposition des personnes intéressées.

The author retains ownership of the copyright in his/her thesis. Neither the thesis nor substantial extracts from it may be printed or otherwise reproduced without his/her permission.

L'auteur conserve la propriété du droit d'auteur qui protège sa thèse. Ni la thèse ni des extraits substantiels de celle-ci ne doivent être imprimés ou autrement reproduits sans son autorisation.

ISBN 0-612-18363-7

Canada

University of Alberta

Library Release Form

Name of Author: Maria Mathews

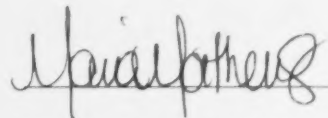
Title of Thesis: Identifying and Predicting Chronic Care Need in the Inuvik
Region, Northwest Territories

Degree: Master of Health Services Administration

Year this Degree Granted: 1996

Permission is hereby granted to the University of Alberta Library to reproduce single copies of this thesis and to lend or sell such copies for private, scholarly, or scientific research purposes only.

The author reserves all other publication and other rights in association with the copyright in the thesis, and except as hereinbefore provided, neither the thesis nor any substantial portion thereof may be printed or otherwise reproduced in any material form whatever without the author's prior written permission.



375 Varsity Close N.W.

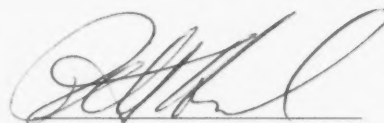
Calgary, Alberta, T3B 2Y9

October 4, 1996

University of Alberta

Faculty of Graduate Studies and Research

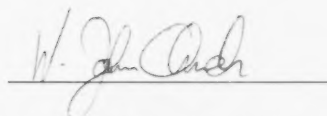
The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled Identifying and Predicting Chronic Care Need in the Inuvik Region, Northwest Territories submitted by Maria Mathews in partial fulfillment of the requirements for the degree of Master of Health Services Administration.



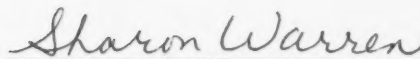
Dr. P. Hessel (Supervisor)



Dr. W.C. Chang (Committee Member)



Dr. J. Church (Committee Member)



Dr. S. Warren (Committee Member)

4-October-1996

Abstract

The study examined previously collected data in the Inuvik Region about individuals requiring chronic care (I.R.C.C.). The study described the characteristics of I.R.C.C. and developed and evaluated two models to forecast need. The first model used a multivariate linear regression, whereas the second used a Markov Chain. The findings can be used to support evidence-based decision making in planning and policy-making.

The study found that need increased with age. Additional investigation may clarify whether aboriginal people have higher levels of need than non-aboriginal people. Both models produced reasonable estimates of need but additional study with larger samples is needed to refine the models and ensure they are statistically appropriate. Modification to the data collection and classification procedures will address a number of limitations to the study.

ACKNOWLEDGEMENT

I am indebted to Dr. Pat Hessel, my supervisor, for his guidance, encouragement and unwavering faith in my abilities. I would like to thank Dr. Wei-Ching Chang, Dr. John Church, and Dr. Sharon Warren for their advice, and particularly for their willingness to accommodate my limited timelines. I am also grateful to Mr. Gian Jhangri and Ms Felicity Hey for their assistance.

I would like to acknowledge the Inuvik Regional Health Board and the Northwest Territories Department of Health and Social Services for their support of this project.

I would like to thank my parents, Sarah and Titus Mathews, and my brothers, Joseph and Titus, for their ongoing support and for their helpful advice. I am also grateful to my Aunt, Mariamma Zachariah, and her family for offering me a home away from home in Edmonton.

Finally, I would like to extend my sincere gratitude to my friends, Bob Barnetson, Derick McNeil, Cathy Barber, Nina Achuthan, Jan Bagh, Carmen Hunt Cormack, and Drew Lockhart.

TABLE OF CONTENTS

1.0 Introduction	1
1.1 Thesis Format	1
1.2 Identification of the Problem	2
1.3 Objectives of the Study	3
1.4 Significance of the Problem	4
1.5 Limitations of the Study	4
1.6 Definition of Terms	4
1.6.1 Individuals Requiring Chronic Care (I.R.C.C.)	4
1.6.1.1 Adult - Level One	5
1.6.1.2 Adult - Level Two	5
1.6.1.3 Adult - Level Three	5
1.6.1.4 Adult - Level Four	5
1.6.1.5 Child - Level One	5
1.6.1.6 Child - Level Two	6
1.6.1.7 Child - Level Three	6
1.6.2 Chronic Care Services	6
1.6.2.1 Homemaking	6
1.6.2.2 Homecare	6
1.6.2.3 Institutional Care	6
1.6.2.4 Respite Care	7

1.7 Background Information	7
1.7.1 Inuvik Region	7
1.7.2 Delivery of Health and Social Services	8
1.7.3 Chronic Care Services	10
1.7.3.1 Joe Greenland Centre	11
1.7.3.2 Long Term Care Ward at the Inuvik Regional Hospital	11
1.7.3.2 Kw'iy Aota' Ko Elders' Facility	11
1.7.3.4 Inuvik Disabled Adult Groups Home	12
1.7.4 Service Requirements Relative to Need	12
1.7.5 Factors Affecting Chronic Care Services	12
1.7.5.1 Fiscal Restraint	12
1.7.5.2 Community Wellness	13
1.7.5.2.1 Community Transfer Initiative	13
1.7.5.2.2 Repatriation	14
1.7.5.2.3 Change in Service Delivery	14
1.7.5.3 Community Concerns	15
1.8 Chapter Summary	16
2.0 Literature Review	17
2.1 Need	17
2.2 Predisposing Factors	17
2.2.1 Age	18

2.2.2 Gender	19
2.2.3 Ethnicity	20
2.2.4 Cause of Disability or Chronic Illness	20
2.2.5 Socio-economic Factors	22
2.3 Chapter Summary	23
3.0 Method	25
3.1 Data Collection	25
3.2 Instrumentation	27
3.3 Data Management	28
3.4 Defined Population	30
3.5 Description of I.R.C.C.	31
3.6 Model A	31
3.7 Model B	34
3.8 Model Evaluation	36
3.9 Need Forecasts	37
3.10 Chapter Summary	37
4.0 Results	39
4.1 Description of Regional Population	39
4.2 Description of I.R.C.C.	39
4.2.1 Age	40
4.2.2 Gender	42
4.2.3 Ethnicity	43

4.2.4 Cause of Disability or Chronic Illness	44
4.2.5 Socio-economic Factors	46
4.3 Model A	47
4.4 Model B	54
4.5 Need Forecasts	55
4.6 Chapter Summary	57
5.0 Discussion	58
5.1 Description of I.R.C.C.	58
5.2 Model A	61
5.3 Model B	62
5.4 Need Forecasts	63
5.5 Implications for Service and Resource Planning	63
5.6 Potential Limitations to Validity	64
5.6.1 Data Collection	65
5.6.2 Instrumentation	66
5.6.3 Forecasting Models	67
5.7 Chapter Summary	68
6.0 Conclusions and Recommendations for Researchers and Policy-makers	68
Bibliography	71
Appendix A: Northwest Territories Assessment and Placement Guide	76
Appendix B: Data Entry Form	83
Appendix C: Model A Calculations	85

Appendix D: Model B Calculations	88
Appendix E: Leslie Matrix Calculations	92
Appendix F: Supplementary Tables	95

List of Tables

Table 1	Independent variables used in each regression in Model A	33
Table 2	Levels of Care of I.R.C.C (1985 - 1995)	40
Table 3	I.R.C.C. by age group (1985-1995)	41
Table 4	Age Group Specific Rate (number of I.R.C.C. per 100 people)	41
Table 5	I.R.C.C. by gender (1985 - 1995)	42
Table 6	Gender specific rate (number of I.R.C.C. per 100 people)	42
Table 7	Gender-age group specific rates (number of I.R.C.C. per 100)	43
Table 8	Gender-age group specific rates (number of I.R.C.C. per 100)	44
Table 9	Ethnic groups specific rate (number of I.R.C.C per 100 people)	44
Table 10	Causes of disability and chronic illness reported by I.R.C.C.	45
Table 11	Regression Coefficients and Model Statistics for Model A	49
Table 12	Predicted I.R.C.C Values using Model A Regressions	51
Table 13	Regression Coefficients and Model Statistics for Pooled Data	52

Table 14	Forecasted number of I.R.C.C. using Pooled Data	
	Regression Equations	53
Table 15	Evaluation of Model A Estimate	53
Table 16	Model B Estimate of 1991 I.R.C.C.	54
Table 17	Evaluation of Model A Estimate	55
Table 18	I.R.C.C. Forecasts for 2005	56
Table D1	Levels of Care of 1985 I.R.C.C. in 1988	89
Table E1	Values for Population Projection	94
Table E2	Projected 2005 Population for the Inuvik Region	94
Table F1	Age group composition of the Inuvik Region population, 1985 - 1995	95
Table F2	Gender composition of the Inuvik Region population, 1985-1995	95
Table F3	Population composition of the Inuvik Region by age and gender, 1985-1995	96
Table F4	Ethnic composition of Inuvik Region Population, 1985-1995	96
Table F5	Specific causes of disability and chronic illness	97
Table F6	Number of reported causes of disability and chronic illness	97
Table F7	Unemployment and Percentage of I.R.C.C. in the population, 1985	98

Table F8	Socio-economic Indicators and Percentage of I.R.C.C. in the population, 1988	99
Table F9	Socio-economic Indicators and Percentage of I.R.C.C. in the population, 1991	100
Table F10	Regression Coefficients and Model Statistics for 1991/95 Pooled Data	101

List of Figures

Figure 1	Map of the Inuvik Region	7
Figure 2	A Markov Chain transition matrix	35
Figure 3	Ten year transition probability matrix	56

List of Abbreviations

A.D.C.I.A.	Aged, Disabled, and Chronically Ill Assessment
D.O.H.S.S.	Department of Health and Social Services
I.R.C.C.	Individuals requiring chronic care
I.R.H.B.	Inuvik Regional Health Board
F.A.E.	Fetal Alcohol Effects
F.A.S.	Fetal Alcohol Syndrome
G.N.W.T.	Government of the Northwest Territories
H.C.P.	Health Care Plan
N.W.T.	Northwest Territories
N.W.T.A.P.G.	Northwest Territories Assessment and Placement Guide
pop	population

1.0 INTRODUCTION

1.1 Thesis Format

The thesis is written in six chapters. Chapter one introduces the problem and outlines the goal, scope and significance of the study. It defines important terms, provides background information about health services in the Inuvik Region, and describes policies which influence the organization and provision of chronic care services. Chapter two is a review of literature relating to need and the predisposing factors of chronic care. Chapter three describes the methodology used in the study. The results are presented in chapter four and discussed in chapter five. Conclusions and recommendations are presented in chapter six. Following the thesis are the bibliography and six appendices.

Appendix A contains the Northwest Territories Assessment and Placement Guide which was used to identify individuals requiring chronic care (I.R.C.C.) and classify their level of need. Appendix B is the data entry form which was used to create an electronic database of client records. Appendix C and Appendix D contain calculations from Model A and Model B respectively. Appendix E is a description of the calculations used to create a Leslie Matrix for population projections. Appendix F contains additional tables referred to in chapters four and five.

1.2 Identification of the Problem

The lack of appropriate and reliable information about health care needs has placed considerable stress on the decision making process in the health care sector (Angus, 1995). Past decisions about the allocation of chronic care resources in the Inuvik Region were believed to have been directed by political influence rather than demonstrated need. Because administrators and policy-makers are forced to make difficult choices, particularly in light of shrinking health care budgets, "evidence based decisions are required to ensure that policies and programs focus on the right issues, take effective action, and produce sound results" (Hamilton and Bhatti, 1996, 8). An essential element of evidence-based decision making is the examination of past need in order to analyse trends and identify emerging issues (Hamilton and Bhatti, 1996).

One of the first examples of data collection to assist decision making in chronic care services in the Northwest Territories was the 1985 Aged, Disabled and Chronically Ill Assessment (A.D.C.I.A.). The study identified all I.R.C.C. due to age, disability or chronic illness. According to Miles Tapping (1989), one of the coordinators of the project, the A.D.C.I.A was organized because "in the context of transfer of responsibilities from the Government of Canada to the territorial governments... it [was] important to know just what responsibilities [were] being transferred, for what services, and for how many people" (145). A complete survey of all communities in the Inuvik Region was repeated in 1988, 1991, and 1995. The results from each A.D.C.I.A were used to keep record of the

individuals who required ongoing assisted living or chronic care services. The data from each A.D.C.I.A. were entered into client summary charts. These charts provided an opportunity to examine and predict chronic care needs of this population.

1.3 Objectives of the Study

The goal of this study was to analyse the client summary charts and develop a better understanding of disability and chronic care needs in the Inuvik Region to facilitate the planning of services. Particular attention was given to the factors which predispose individuals to chronic care need. The objective was to describe the characteristics of the I.R.C.C., and to develop and evaluate two forecasting methods to predict chronic care needs to the year 2005.

1.4 Significance of the Study

This study was the first detailed analysis of chronic care needs in the Inuvik Region. It was a response to the need to provide administrators and care providers with information to support evidence-based decision making in the chronic care sector. The information can also serve as the first step in a planning process for chronic care and prevention programs. The results can be used for comparison with other regions in the Northwest Territories. Lastly, problems encountered in using the Northwest Territories Assessment and Placement Guide

(N.W.T.A.P.G.) for describing and predicting need may lead to useful modification of the instrument and assessment methodology.

1.5 Limitations of the Study

The study relied exclusively on the data gathered during each A.D.C.I.A. Both the analysis conducted and the models developed were limited by the type and scope of the information gathered about each I.R.C.C. Moreover, the data collection methodology used in the A.D.C.I.A. may have introduced limitations to this study with regard to the reliability and accuracy of the number of identified I.R.C.C. These potential limitations are discussed in chapter five.

Although the Inuvik Region is geographically large, it has a very small population compared to other health regions in southern Canada. The total population of the Region during the period studied was less than 10 000 people, of whom, two to three percent required chronic care. Because of the small sample size, it was difficult to determine whether the forecasting models were statistically appropriate, and as such, the findings of the study were largely exploratory in nature.

1.6 Definition of Terms

1.6.1 Individuals Requiring Chronic Care (I.R.C.C)

I.R.C.C. includes exclusively those individuals who are identified by the N.W.T.A.P.G. as requiring ongoing assistance (Appendix A). The levels of need

defined by the N.W.T.A.P.G. may differ from the definitions of need and of disability used by other assessment tools and disability surveys. The Department of Health and Social Services (D.O.H.S.S.) classifies degree of chronic need into four levels for adults (individuals age 18 years and over) and three levels for children (G.N.W.T., 1987).

1.6.1.1 Adult - Level One An adult at level one is essentially independent but may require guidance or supervision with some activities of daily living. Care is generally provided in the home by family or, when required, by community support programmes.

1.6.1.2 Adult - Level Two An adult at level two is able to get around safely with or without aides, is able to assist in dressing and feeding and is usually continent. Care may be provided in the home by family and community support programmes, or in a residential setting such as a personal care home or multi-level care home.

1.6.1.3 Adult - Level Three An adult at level three requires more than assistance and supervision with activities of daily living and is usually not continent. Care may be provided in the home by family and community support programmes, or in a residential setting such as a personal care home or multi-level care home.

1.6.1.4 Adult - Level Four An adult at level four requires regular and continuous medical attention, and highly skilled technical nursing supervision on a 24 hour basis. Care is provided in a hospital extended care unit.

1.6.1.5 Child - Level One A child at level one requires more assistance with activities of daily living and life skills than is within the normal range for children of

the same age because of developmental delay, cognitive, or physical impairment.

The child is expected to become independent in activities of daily living as an adult.

1.6.1.6 Child - Level Two A child at level two is not expected to become independent in all activities of daily living as an adult because of a physical or cognitive impairment.

1.6.1.7 Child - Level Three A child at level three has a severe physical or cognitive impairment and is expected to remain physically dependent for activities of daily living.

1.6.2 Chronic Care Services

Chronic care services include homemaking (also known as home support), homecare, institutional long term care, and respite care.

1.6.2.1 Homemaking Homemaking is provided by home support workers who clean houses, prepare meals, launder clothes, assist in shopping and errands, aid in personal grooming and hygiene, and perform basic nursing skills. Homemaking is provided in clients' homes.

1.6.2.2 Homecare Homecare is provided by nursing staff who deliver nursing care to patients. The service is provided in the clients' home.

1.6.2.3 Institutional Care Individuals who require institutional long term care are dependent upon ongoing supervision or nursing care which is only available (unless privately funded) in public institutions such as nursing homes (also referred to as seniors homes or old folks homes), group homes, or hospitals.

1.6.2.4 Respite Care Respite care is the temporary lodging of an I.R.C.C. in a long term care institution. Respite care is usually used to relieve primary care givers of their duties for short periods of time (a few days to two months).

1.7 Background Information

1.7.1 Inuvik Region

The Inuvik Region extends from the south shore of Great Bear Lake to Banks Island in the Beaufort Sea (Figure 1). It includes twelve communities.

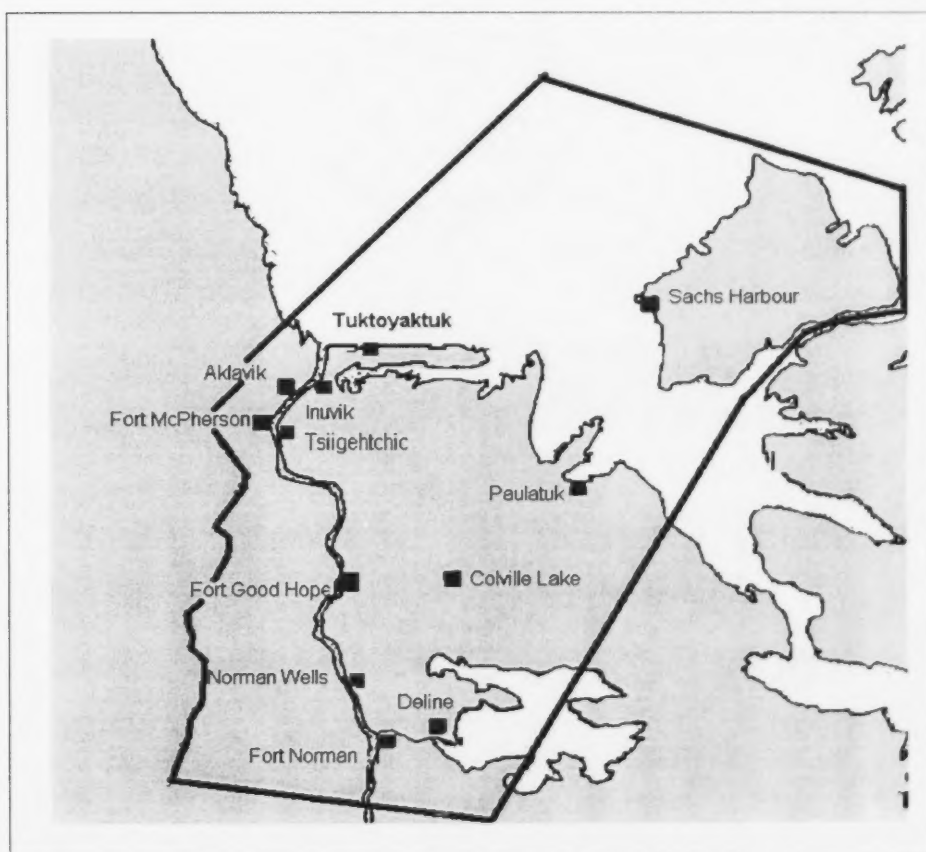


Figure 1. Map of the Inuvik Region.

The seven northernmost communities are collectively known as the Beaufort-Delta communities: Sachs Harbour, Tuktoyaktuk, Paulatuk, Inuvik, Aklavik, Fort McPherson, and Tsiigehtchic (formerly known as Arctic Red River).

The five southernmost communities are collectively known as the Sahtu communities: Fort Good Hope, Colville Lake, Norman Wells, Tulita (formerly known as Fort Norman) and Deline (formerly known as Fort Franklin).

Between 1985 and 1995, Inuvialuit (a cultural group of the Inuit), Gwich'in, Sahtu Dene, Metis and non-aboriginal people lived in the Region. Most Inuvialuit people lived in Sachs Harbour, Tuktoyaktuk, Paulatuk, Inuvik, and Aklavik. Most Gwich'in resided in Inuvik, Aklavik, Tsiigehtchic, and Fort McPherson; and the Sahtu Dene in Fort Good Hope, Colville Lake, Norman Wells, Tulita, and Deline. Metis lived in almost all of the communities. Non-native people resided in all communities, although their numbers were highest in Inuvik and Norman Wells (I.R.H.B., 1996a).

1.7.2 Delivery of Health and Social Services

Prior to 1988, the Medical Services Branch of Health and Welfare Canada administered and delivered health services in the Northwest Territories. In 1988, responsibility for health services was transferred to the Department of Health of the Northwest Territories, which established six¹ regional health boards to deliver and administer services.

¹ A health board was not established in the MacKenzie/ Deh Cho Region.

Health services were delivered by the Northwest Territories Department of Health.

Health services in the Inuvik Region are delivered through health centres or health stations located in each community and the Inuvik Regional Hospital located in Inuvik. Health centres are found in communities with populations greater than 200 people²: Sachs Harbour, Tuktoyaktuk, Paulatuk, Aklavik, Fort McPherson, Fort Good Hope, Norman Wells, Tulita, and, Deline. Community health stations are located in communities with populations less than 200 people (Colville Lake and Tsiigehtchic).

Health centres are staffed by nurses, community health representatives, support staff, and, in some communities, dental therapists. Health centres are open daily for sick clinics, routine public health clinics, educational workshops and community development programs. Nursing staff are on call after regular hours to provide 24 hour emergency coverage. Each community health station is staffed by a lay dispenser who, during emergencies, assesses patients and provides treatment according to directions given by physicians or nurses. Each week, nurses from Fort Good Hope visit Colville Lake and nurses from the Inuvik Regional Hospital visit Tsiigehtchic. Physicians visit each community either once a month or once every six weeks (depending on the population of the community).

² Although Sachs Harbour has a population of approximately 130 people, it has a health centre because of its geographical isolation. Located on Banks Island, Sachs Harbour is often inaccessible because of adverse weather conditions.

Patients are transferred to the Inuvik Regional Hospital to access specialist and inpatient services³. The hospital operates 26 acute care beds and 16 long term care beds. The hospital provides diagnostic, therapeutic, rehabilitation and prevention services for both the hospital and the community health centres. Unlike most hospitals in the south, the Inuvik Regional Hospital has a hostel (called the Transient Centre) for out of town patients who do not require inpatient services. Patients requiring additional health services are transferred to Stanton Yellowknife Hospital in Yellowknife or the Capital Health Authority in Edmonton.

1.7.3 Chronic Care Services

Between 1985 and 1995 responsibility for assisted living services for the disabled and chronically ill were shared between the Department of Health and the Department of Social Services. In 1985, Inuvik was the only community in the Region with homecare and homemaking programs. In 1995, Inuvik was the only community with designated staff for the homecare programme. In the other communities, health centre nurses provided limited homecare services. The I.R.H.B. employed two homemakers in Inuvik. In the other communities, Social Services awarded contracts to band and hamlet councils to provide homemaking services in their community. In 1995, six communities were awarded homemaking contracts.

³ As of April 1, 1995, residents of Deline, Fort Norman, and Norman Wells accessed hospital and specialist services from the Stanton Yellowknife Hospital in Yellowknife.

In 1985, there was one long term care facility in the Region. In 1995, there were four. All four institutions offered respite care.

1.7.3.1 Joe Greenland Centre The Joe Greenland Centre in Aklavik was the only long term care facility in the Region which was in operation in both 1985 and 1995. In 1995, it had eight level two beds. The centre also included seven level one apartments for seniors who required minimal assistance (such as homemaking).

1.7.3.2 Long Term Care Ward at the Inuvik Regional Hospital A designated long term care ward was added to the Inuvik Regional Hospital between 1985 and 1988 (Personal Communication, Holly Fletcher-Best, February 19, 1996) Prior to its construction, I.R.C.C. were admitted to either the acute care ward or the maternity and surgery ward.

In 1995, the long term care ward had 14 resident and two respite beds for chronically disabled young adult and geriatric patients who required ongoing supervisory and nursing care (level three and four). Residents in the ward could not be cared for in their homes or in the other long term care facilities in the Region because of the severity of their conditions and the lack of appropriate medical services in the communities.

1.7.3.3 Kw'iy Aota' Ko Elders' Facility The facility, located in Deline opened in 1993. In 1995, it had six level two beds and ten level one apartments for clients over the age of 50.

1.7.3.4 Inuvik Disabled Adult Group Home. Located in Inuvik, the Inuvik Disabled Adult Group Home opened in 1995. It had 6 resident and 2 respite beds. Eligible clients were level two I.R.C.C between the ages of 18 to 40 years.

1.7.4 Service Requirements Relative to Need

Adults at levels one and two may be able to remain independent and in their own homes with homemaking and, if necessary, homecare. Generally, adults at levels three and four require long term care. Children at levels one and two can be cared for in their own homes by their parents. Depending on the nature of their disability and the willingness of their parents, children at level three can be cared for in their own homes or in a long term care institution. Respite care is usually provided for adults at levels two, three, and four, or children at levels two and three.

1.7.5 Factors Affecting Chronic Care Services

The creation and organization of chronic care services in the Region is influenced by a number of Territorial government policies and objectives (such as the Community Wellness strategy) as well as community concerns. However, underlying all government initiatives is fiscal restraint.

1.7.5.1 Fiscal Restraint Since 1992, the Department of Health and Social Services has seen significant growth in expenditures, and has adopted measures to reduce spending. One major initiative is the development of population based funding formulas to provide regional and community agencies with block funding for programs. A second major cost cutting initiative was the amalgamation of the Department of Health and the Department of Social Services in June 1994. The

consolidation of health and social services at regional and community levels is presently underway.

1.7.5.2 Community Wellness The Community Wellness policy calls for less control by government and greater involvement by communities through prevention, healing and treatment programs; education and training of local people; inter-agency collaboration; and community empowerment through more control of local services (Benoit, 1995). The policy promotes the concept of a healthy community which is characterised by a strong sense of community and family life, a state of personal and community well-being, the preservation of culture and tradition, and integrated services provided by community members and care givers working cooperatively (Benoit, 1995). In the context of chronic care services, the Community Wellness policy encourages communities to care for their own people wherever possible by means of the Community Transfer Initiative, the Repatriation policy, and changes in care delivery.

1.7.5.2.1 Community Transfer Initiative. The Community Transfer Initiative is geared toward increasing community responsibility for services and programs by transferring program funding from the Territorial government to a local band or hamlet council. The goal of the initiative is to provide communities with the opportunity to restore local responsibility and self-sufficiency; to address economic and social problems by establishing local priorities; and to produce an efficient, responsive, and cost-effective system of government (Department of Health, 1993). Under the initiative, communities will increasingly assume the

responsibility for planning, administration, and delivery of programs and services. Regional agencies will support the communities through programme development, and manpower training. An example of the Community Transfer Initiative in the chronic care sector is the transfer of responsibility for the Joe Greenland Centre from the Department of Health and Social Services to the Aklavik Aboriginal Committee.

1.7.5.2.2 Repatriation. Previously, when adequate services and facilities were unavailable in the North, individuals with mental and physical disabilities were placed in the South. Under the repatriation policy, individuals placed in southern institutions will be relocated to facilities in the North. The policy is part of broader objectives to develop northern resources for individuals with special needs, to preserve northern culture, to strengthen family bonds, to promote community wellness, and to reduce government expenditures (The Repatriation Task Group, 1996).

1.7.5.2.3 Change in Service Delivery. Throughout North America, the emphasis of social and health services has shifted towards ambulatory care, provided in home-like settings, by a team of care providers (I.R.H.B., 1996c). The change in service delivery de-emphasizes institutionalized programmes, especially for physically and mentally disabled individuals who require ongoing care. The approach in the Inuvik Region was to provide services by local care providers and family members, in home-like environments, as close to the home community as possible (I.R.H.B., 1996c).

1.7.5.3 Community Concerns The planning and provision of chronic care services in the Inuvik Region was a growing concern for both residents and health administrators (I.R.H.B., 1996). In a recent needs assessment, seven communities expressed a desire to have a facility like the Joe Greenland Centre. Residents in these communities said that "elders are a valuable resource ... [they] would like to keep elders in the community rather than see them leave because appropriate facilities or services [were] not available" (I.R.H.B., 1995, 35). Elders play a leading role in the political and social activities in the community. They are a link to the past and are seen as a valuable resource for preserving traditional lifestyles and values. Moreover, communities in the Region are separated by considerable distances, and some are only accessible by air travel. Removing individuals from their home community in order to access chronic care services breaks up families and removes social support networks.

The creation of chronic care programs can also play a role in the economic and social development of a community. It provides the opportunity to train local (aboriginal) care providers and to boost the local economy.

Nonetheless, funding for chronic care programs is limited. Seniors' facilities are expensive to construct and operate. Since opening in 1993 and 1995 respectively, both the Kw'iy Aota' Ko Elders Facility and the Inuvik Disabled Adult Group Home have operated at half their capacities. Reducing operations is not economically advantageous because most expenses are fixed costs (given the small size of the facilities). When planning chronic care programs, administrators must

not only consider funding, government policies, and community concerns, but also the need for chronic care services.

1.8 Chapter Summary

Chapter one identified the problem and outlined the context in which the problem will be considered. The next chapter examines a review of selected literature to develop an understanding of chronic care need in Canada.

2.0 LITERATURE REVIEW

2.1 Need

According to Donabedian (1973), a planning process must consider three elements: need, service, and resources. Need is a "service requiring potential" (Donabedian, 1973, 65). Service is the required care procedure, and resource is the supply or source of the service. These three elements are inter-related. Identifying and describing need allows planners to determine required services as well as the resources required to produce them.

Need in this study referred to the requirement for chronic care services. Service referred to the types of chronic care services, and resource referred to the various elements required to provide the service (for example, human resources, finances, capital, and policies). In a complete planning exercise, all three elements and factors which influence them are considered. This study however, focused on needs and the factors which affect them.

2.2 Predisposing Factors

Need for health services is not uniform in a population; some individuals are more likely than others to have greater need. Wolinsky, Stump, and Johnson (1995) suggested that need is a function of an individual's predisposing characteristics (individual traits which exist prior to the onset of illness and disability). Predisposing factors such as demographic features, social structures,

beliefs, and attitudes can be used to predict the differential propensity of need between groups (Starrett, Rogers, and Walters, 1988; Ward, 1977; Anderson and Newman, 1978). Age, gender, and marital status, to name a few, are predisposing factors which have been studied in relation to use of chronic care services (Starrett et al., 1988; Wolinsky, 1978).

This study examined both demographic and socio-economic predisposing factors. The demographic factors included the gender, age, and ethnic composition of a community. The socio-economic factors included (on a community level) unemployment rate, mean annual income, educational attainment, and number of individuals per household.

A number of studies and surveys have described the extent and causes of chronic illness and disability in Canada in relation to demographic and socio-economic predisposing characteristics. Less, however, is known specifically about the chronic illness and disability among different ethnic groups in Canada, particularly aboriginal people.

2.2.1 Age

The 1983 -1984 Canadian Health and Disability Survey described disability (limitation in normal daily activity) among people age 15 and over⁴ and the 1986 - 1987 Health and Activity Limitation Survey described both children and adults

⁴ The Canadian Disability Survey did not include "residents of the Yukon, Northwest Territories, persons living on Indian reserves, full-time members of the armed forces and persons living in institutions" (Statistics Canada, 1985, 12).

who reported a limitation in the "kind or amount of activity they could undertake because of a health problem or condition" (Statistics Canada, 1990, xix). Both surveys, as well as 1986 census data, found that a greater proportion of Canadians age 65 years or older were disabled than Canadians under the age of 65 (Statistics Canada, 1985; Statistics Canada, 1990; Nessner, 1994). Moreover, Nessner reported that 82% of people aged 85 years or greater were disabled.

The A.D.C.I.A., conducted by the N.W.T. Department of Health in 1985-1986, was the first extensive study of chronic care needs among N.W.T. residents (G.N.W.T., 1987). A comparison of the results of the A.D.C.I.A. and the Canadian Disability Survey, showed that similar disability rates existed among people over the age of 65, although N.W.T. elderly more often reported milder disabilities (Miles-Tapping, 1989). In the Inuvik Region, the 1985/86 assessment found that 61% of all I.R.C.C. were 65 years of age or more (G.N.W.T., 1987). Furthermore, I.R.C.C. in this age group had higher levels of need than I.R.C.C. between 15 and 64 years of age. The 1995 A.D.C.I.A. update in the Inuvik Region identified a total of 284 I.R.C.C., of whom 246 (86.6%) were 18 years of age or more (I.R.H.B., 1996b). However, a greater proportion of I.R.C.C. under the age of 18 years (42%) were at a higher level of need (level three) than those I.R.C.C. age 18 years or more (12% at level three and four) (I.R.H.B., 1996b).

2.2.2 Gender

The Canadian Disability Survey found that a greater proportion of females than males, in all age groups, were disabled (Statistics Canada, 1985; Nessner,

1994). However, the Health and Activity Limitation Survey found that under the age of 55, disabled males outnumbered disabled females, whereas age 55 years or more, disabled females outnumbered disabled males (Statistics Canada, 1990). Cassou, Derriennic, Iwatsubo, and Amphoux (1992) argued that when the longer life expectancy of females was taken into consideration, that disability rates between the genders did not differ significantly.

2.2.3 Ethnicity

Little information was available on disability rates among different ethnic groups. However, in examining the data from the 1985-86 A.D.C.I.A., Miles-Tapping (1989) found that communities with greater concentrations of non-aboriginal people appeared to have a lower prevalence of disability. Miles-Tapping attributed this finding to the "healthy worker effect"; good health is required for initial and continuing employment; mortality rates are lower among employed persons than the general population (Monson, 1986). Most non-aboriginal people moved to the Region for employment opportunities and generally returned to the South when employment ceases or when long term medical care is required (Personal Communication, Margaret Marshall, February 1, 1995).

2.2.4 Cause of Disability

According to a number of Canadian studies, the leading causes of disability among all age groups (residing in their own homes and in institutions) were: (a) diseases of the musculoskeletal system and connective tissue (including limb and joint

disorders), (b) diseases of the circulatory system, (c) diseases of the nervous system (including vision and sense disorders), (d) mental disorders, (e) trauma, (f) diseases of the respiratory system, (g) congenital anomalies and perinatal defects, and (h) diseases of the digestive system (Peron and Strohmenger, 1985; Statistics Canada, 1985; Statistics Canada, 1990, Alberta Health 1991). The causes of disability vary according to region and age. A 1991 study profiling the residents of long term care facilities in Alberta found that the most common medical diagnoses of residents under the age of 65 were: (a) multiple sclerosis, (b) epilepsy, (c) depression, (d) mental retardation, and (e) paralysis; whereas, among residents over the age of 65, the most common medical diagnoses were (a) osteoarthritis, (b) dementia (not including Alzheimer's), (c) hypertension, (d) diabetes, (e) heart failure, (f) Alzheimer's disease, and (g) Chronic Obstructive Pulmonary Disease (Alberta Health, 1991). Cerebrovascular accidents were a cause of disability in both age groups. Most disabled individuals report more than one cause of disability (Peron and Strohmenger, 1985; Statistics Canada, 1985; Statistics Canada, 1990, Alberta Health 1991).

Among aboriginal people, diabetes is the most commonly reported chronic condition (McClure et al., 1991), especially in the Western provinces (Bobet, 1994). Native people are also more likely than other Canadians to report respiratory diseases (McClure et al., 1992; Bobet, 1994; I.R.H.B., 1996a). Tuberculosis rates among natives also exceeded the Canadian rate (Bobet, 1994; Territorial Health Insurance Services Board and The Department of Health, 1990).

Little information was available about disabilities arising from accidents or chronic diseases in the Northwest Territories (Territorial Health Insurance Services Board and The Department of Health, 1990).

2.2.5 Socio-economic Factors

Four socio-economic indicators were of interest in this study: (a) unemployment, (b) income, (c) education, and (d) housing. A number of studies have documented the correlation between disability, unemployment, and income in Canada. Unemployed individuals had greater rates and severity of disability and report more health problems (D'arcy and Siddique, 1985; Ross and Shillington, 1990), especially musculoskeletal disorders (Badley and Ibanez, 1994) than the general population. Disabled people also had lower incomes than the general population, especially disabled women (Ross and Shillington, 1990). Disabled people also had lower levels of formal education than the general population (Ross and Shillington, 1990; Social Trends Analysis Directorate, 1986). Moreover, Badley and Ibanez (1994) found that lower educational attainment was associated with increased risk of disability. The association between unemployment, low income, low educational attainment and disability was not surprising because the three characteristics are interrelated (Badley and Ibanez, 1994); lower levels of education results in lower employability resulting in lower annual income. Finally, with regard to housing, a greater proportion of non-institutionalized disabled people live either alone or with non-relatives than the general population (Ross and Shillington, 1990; Social Trends Analysis Directorate, 1986).

Although significant associations between unemployment, income, education and housing have been found, these factors may not have been accurate indicators of disability in the Northwest Territories. In the Inuvik Region, as with the rest of the N.W.T., unemployment rates exceeded the national average (I.R.H.B., 1996a), and hence may not have been a sensitive indicator for disability; unemployment rates for native people were twice as high as unemployment rates among non-native people, and four times higher among natives aged 15 - 24⁵ (Territorial Health Insurance Services Board and The Department of Health, 1990). Educational attainment, on average, was lower in the Region (and in the rest of the Northwest Territories) than in the rest of Canada (I.R.H.B., 1996a). Aboriginal residents in the Region may not have had access to more than the minimal educational resources. Finally, housing statistics in the Region may not have reflected housing trends in the rest of Canada because many extended families continue to live together, and because available public housing was limited in most communities in the Region (I.R.H.B., 1996a). The number of individuals per household, therefore, may not have been a reliable indicator of disability.

2.3 Chapter Summary

Chapter two summarized the literature relating to need and predisposing factors of chronic care need and provided information about the indicators which

⁵ The high unemployment rate was not due to native people choosing to pursue traditional activities (Territorial Health Insurance Services Board and The Department of Health, 1990).

can be used to predict chronic care need. The next chapter outlines the method used to collect data, to describe the I.R.C.C., and to develop and evaluate two forecasting models.

3.0 METHOD

3.1 Data Collection

The purpose of the A.D.C.I.A. was to identify each individual who required some form of chronic assistance according to the levels of need described in the N.W.T.A.P.G. The A.D.C.I.A. was conducted in each of the 12 communities in the Inuvik Region in 1985, 1988, and 1995. Records were available for all communities except Sachs Harbour, Paulatuk, and Tsiigehtchic in 1991. Similar methods were used to identify and classify I.R.C.C. during each A.D.C.I.A.

Project staff for each A.D.C.I.A. consisted of placement assessors and project coordinators. Assessors were care providers such as nurses, occupational and physical therapists, and social services workers who had some previous experience with chronic care. Assessors visited communities, identified I.R.C.C., classified them according to level of need, and gathered supporting documentation. Project coordinators were responsible for administrative matters and reviewing client summary charts for completion and accuracy. Prior to each A.D.C.I.A., resource personnel from the Department of Health and Social Services trained all project staff on the N.W.T.A.P.G. and its application. In each A.D.C.I.A., the project staff consisted of different people.

In each community, assessors conducted interviews with care providers such as community health centre personnel, community social services workers,

teachers, band or hamlet officials and, in some places, members of the elders' committee. Respondents were asked to identify individuals who they felt required chronic assistance and why. Because of the relatively small size of the communities, care providers and community officials know community members well, and thus were believed to be able to provide a complete list of I.R.C.C. Assessors also reviewed patient lists from the chronic illness clinic⁸ and prescription lists⁹ in order to complete a preliminary list of I.R.C.C.

Project staff then reviewed the medical charts of each individual to document their level of need. These charts included age, health care plan number (H.C.P.), medical diagnosis and treatments, family and social history as well as other pertinent information. Those I.R.C.C. who were believed to be at level two or greater were personally visited by project staff and assessed according to the N.W.T.A.P.G. During personal assessments, each individual was briefed on the

⁸ Each community health centre organizes a weekly chronic illness clinic during which time health centre staff monitor patients with chronic illnesses. The chronic illness clinic is a part of the community health centres public health programme.

⁹ In all communities in the Region except for Inuvik, prescriptions are filled by the community health centre. Medications which are not on the health centre formulary are mailed to the health centre from the Inuvik Regional Hospital or from a privately owned pharmacy located in Inuvik. Health centre nurses sort and distribute medications on a weekly basis.

purpose of the study. Signed consent was obtained before assessments were conducted and translators were provided where necessary. Records from the 1995 A.D.C.I.A. indicated that two people refused a personal assessment and that another three were unavailable for personal assessment. Records did not indicate the number of individuals who refused personal assessment in the other years of the study, but these were also believed to be small.

Assessors then categorized each individual's level of need according to the criteria set out in the N.W.T.A.P.G., and information was summarized onto the client summary charts. Each record was independently reviewed by another project staff member, either another assessor or the project coordinator, all of whom had received training on the use of the N.W.T.A.P.G. Disagreements over classification were discussed between the reviewer and the assessor, and levels of need were reclassified by consensus of both raters.

The methodology used to collect data relied on a network of community care providers and health records in order to identify I.R.C.C. Potential weaknesses in the methodology, which may threaten the validity of the A.D.C.I.A. results, are discussed in chapter five.

3.2 Instrumentation

The N.W.T.A.P.G. was used to categorize level of need (G.N.W.T., 1987). The tool measured an individual's ability to perform activities of daily living, ability to travel, ability to perform household activities, medical-biological status, and

psycho-social status (Personal Communication, Margaret Marshall, February 1, 1995). Medical diagnoses (supported by a medical chart review), although recorded, did not form the basis for categorization of need, as they were not accurate indicators of care requirements. Moreover, the levels of need provide information regarding the types of assistance required and provide information useful for planning (Miles-Tapping, 1989). During the 10 year period covered in the analysis the guide has not been significantly altered.

The Department of Health and Social Services classifies level of chronic need into four levels for adults (individuals 18 years of age and over) and three levels for children (G.N.W.T., 1987). Each level is described in chapter one.

3.3 Data Management

The data from the client summary charts were entered into an electronic data base using the Data Entry Form (Appendix B). The year of study (1985, 1988, 1991, 1995) was entered into the field labelled "YEAR". The individual's home community and N.W.T. health care plan number was entered into the field labelled "COMMUNITY" and "HCP" respectively. The individual's ethnicity, year of birth and gender were entered into the fields labelled "ETHNICITY", "BIRTH", and "SEX" respectively. Ethnicity was determined by the first letter of the H.C.P. number which distinguishes individuals by ethnicity, namely: (a) T for Inuit (specifically the Inuvialuit in the Inuvik Region), (b) D for Dene (specifically the Sahtu and Gwich'in people), (c) M for Metis, and (d) N for non-native.

Each disease condition for each individual was entered into one of 14 categories. Within some of these categories, specific conditions were also entered: (a) diseases of the circulatory system (with specific note of heart disease, and hypertension), (b) diseases of the musculoskeletal system (with specific note of arthritis and rheumatism), (c) diseases of the respiratory system (with specific note of asthma, and chronic obstructive respiratory disease), (d) mental disorders (with specific note of Alzheimer's disease), (e) congenital anomalies (with specific note of Down's syndrome and fetal alcohol syndrome), (f) diseases of the digestive system, (g) diabetes, (h) multiple sclerosis, (i) epilepsy, (j) paralysis, (k) cerebral palsy, (l) blindness, (m) deafness, and (n) other. The individual's level of need was entered into the field labelled "LEVEL OF NEED". Mental retardation and mental illness were included under the "mental disorders" category. The "blindness" and "deafness" categories included all types of vision and hearing problems. The categories used in this study were similar to the categories used in the Canadian Health and Disability Survey (1983-84) and the Health and Activity Limitations Survey (1986-87).

Two measures were taken to ensure the database was complete and accurate. First, the H.C.P. number (an unique identifier) was used to verify that duplicate records were not entered. Second, during each A.D.C.I.A., project staff recorded the date when clients no longer required chronic care (because of death; improvement in health; or for non-native clients, emigration from the Region).

These dates were used to verify whether records should have been included or removed from each A.D.C.I.A list.

Annual income statistics for the communities in the Region were available from 1986 to 1992, and unemployment rates were available for selected years between 1986 and 1994. Because the mean annual income and unemployment rate fluctuate considerably, 1995 values were not estimated. Income and unemployment statistics were calculated by Statistics Canada and the N.W.T. Bureau of Statistics. The percentage of individuals with less than a grade twelve education, and the percentage of households with one individual and more than six individuals was taken from the 1991 Aboriginal Peoples Survey (as presented in the Inuvik Region Profile) (I.R.H.B., 1996a).

3.4 Defined Population

The population for the study included all residents of the surveyed communities. I.R.C.C. outside of their home community at institutions⁸ were included in the population of their home community (assuming that, if appropriate services were available, they would continue to reside in their home community). Home community was identified on the client summary charts. Community populations were adjusted to account for the addition or loss of individuals in each community.

⁸ I.R.C.C. outside the Region generally live in Yellowknife or Edmonton.

3.5 Description of I.R.C.C.

Once data were entered, the I.R.C.C. for each A.D.C.I.A. year was described according to age group, gender, and ethnicity relative to the total number of I.R.C.C. and the total Regional population. Category specific rates (number of I.R.C.C. per 100 people) were calculated for age, gender and ethnic groups. Age-gender group specific rates were also tabulated. However, age-gender specific rates were not calculated for each ethnic group because population composition by age, gender and ethnic group was not available.

Separate rates by age, by gender and by ethnic group were not calculated for the causes of disability and chronic illness. The number of cases in each category were too small to produce stable rates.

Socio-economic factors were described for each community rather than I.R.C.C. because this information was not collected for each I.R.C.C. Potential correlation between each indicator and the percentage of I.R.C.C. in the population were examined.

3.6 Model A

The first forecasting model developed was an ecological model which used multivariate linear regression to calculate the percentage of I.R.C.C. in the community population. Multivariate linear regression has been previously used to study the relationship between predisposing factors and health services utilization. In 1978, Wolinsky studied the relationship between an individual's predisposing

characteristics and health services utilization. Wolinsky et al. (1993) used data on predisposing, enabling, and need factors to examine the volume and consistency of hospital utilization. This study applied similar statistical models to health status needs rather than service utilization.

Initially, a multivariate linear regression was to be developed for each level of need for each A.D.C.I.A. year. However, because of the small number of adults at level three and level four, and the small number of children requiring chronic care, none of the independent variables achieved statistical significance. The original model was then slightly modified.

A single multivariate linear regression model was developed to predict the percentage of the community population which required chronic care at any level (the dependent variable) using independent variables which described the predisposing factors for each community. A model was developed for each A.D.C.I.A. year. Table 1 shows the independent variables entered into each regression.

Table 1.

Independent variables used in each regression in Model A

Independent Variable	1985	1988	1991	1995
% males in the population	x	x	x	x
% Dene in the population	x	x	x	x
% Inuit in the population	x	x	x	x
% non-aboriginals in the population	x	x	x	x
% of population between 20 and 39	x	x	x	x
% of population between 40 and 59	x	x	x	x
% of population between 60 and 79	x	x	x	x
% of population 80 and over	x	x	x	x
Unemployment rate	x	x	x	
Mean annual income		x	x	
% of population with less than high school			x	
% of population with 1 person/house			x	
% of population with 6 or more people/house			x	
x = entered into regression model				

Bivariate linear regression analysis was used to assess the degree of association of each independent variable with the dependent variable, and to screen for

potentially significant associations for subsequent multivariate analysis. The criteria for removal was $p \leq 0.40$. Category specific rates were also considered to judge whether variables should be removed from the regression equation (i.e. category specific rates were used to intuitively evaluate potential significance). Backward stepwise regression was then used to determine the significant variables in each regression equation.

The regression model produced coefficients which were used to determine the percentage I.R.C.C. in the population. To calculate the number of I.R.C.C., this value was multiplied by the total population. The number of people at each level of care was estimated by multiplying the calculated number of I.R.C.C. within each community by the overall proportions of individuals at each level of care. Appendix C contains a sample calculation for a forecast using Model A.

3.7 Model B

The second forecasting model used a Markov chain which is useful for studying the progression of disease (Jain, 1986) and for forecasting the state of a system at some future time (Swain, 1981). The model determines, for longitudinal data, the probabilities of change in disease/need from various starting points.

The probabilities are used to predict future outcomes. The Markov chain has been applied in the long term care sector to examine the progression of clients requiring chronic care services. Boulton, Kane, Louis, and Ibrahim (1991) used Markov chains to project transition rates to and from levels of functional ability, as

well as mortality rates. Norton (1992) examined the relationship between nursing home funding schedules and change in health status of nursing home patients.

The Markov chain describes the progression of I.R.C.C. through various levels of need. Each element in the transition matrix, P , defines the probability of an individual moving from one state to another within a given time period. Figure 2 is an example of a three state transition matrix.

$$P = \begin{bmatrix} P_{11} & P_{12} & P_{13} \\ P_{21} & P_{22} & P_{23} \\ P_{31} & P_{32} & P_{33} \end{bmatrix} = \begin{bmatrix} 0.5 & 0.2 & 0.3 \\ 0.1 & 0.2 & 0.7 \\ 0.4 & 0.4 & 0.2 \end{bmatrix}$$

Figure 2. A Markov chain transition matrix.

The first digit in the subscript represents the row position (i.e. classification at the beginning of the transition period $[t_1]$). The second digit in the subscript represents the column position (i.e. the classification at the end of the transition period $[t_2]$). P_{11} (0.5) describes the probability of an individual from state one remaining in state one. P_{12} (0.2) describes the probability of an individual from state one moving to state two (0.2). Note that the sum of the probabilities in each row of the matrix is one.

To develop the Markov chain, the levels of care of I.R.C.C. were recorded at the beginning and end of the transition period. At the beginning of the transition period, all individuals in the population were classified into one of seven levels of care or as not requiring care. At the end of the transition period, they were

counted in one of nine categories: (a) adult - level one, (b) adult - level two, (c) adult - level three, (d) adult - level four, (e) child - level one, (f) child - level two, (g) child - level three (h) alive and no longer requiring chronic care services, or (i) dead. Calculations for a three year projection are shown in Appendix D.

3.8 Model Evaluation

In order to evaluate Model A, the regression equation from each A.D.C.I.A. year was used to predict the I.R.C.C. in another year. In order to evaluate Model B, data from 1985 and 1988 were used to develop a transition probability matrix and predict the number of I.R.C.C in 1991.

This study used the evaluation measures described by Lane, Uyeno, Stark, Kliewer, and Gutman (1985) in their study of forecasting models. Five measures were used: (a) mean absolute deviation, (b) bias, (c) weighted absolute deviation, (d) weighted bias, and (e) X^2 . For each of the measures, the closer the value was to zero, the closer the projections were to actual values. Mean absolute deviation described the mean size of error by summing the absolute values of the difference between the predicted and actual values and then calculating the mean. Because absolute values were used, the direction of error was not measured. Bias is the sum of the difference between the predicted and actual values. Bias measured the direction of error. Weighted absolute deviation is the sum of the absolute values of the differences between the predicted and actual values for each level of care, divided by the actual total number of I.R.C.C. It is expressed as a percentage.

Weighted bias is the sum of the differences between the predicted and actual values for each level of care, divided by the actual total number of I.R.C.C. The χ^2 test statistic was used to test the significance of the null (H_0) and alternative (H_A) hypotheses:

H_0 : the difference between the predicted and actual values was not statistically significant; the actual values can be predicted by the model

H_A : the difference between the predicted and actual values was statistically significant; the actual values can not be predicted by the model.

Because of the small size of the sample, the hypotheses was tested at $\alpha = 0.10$.

3.9 Need Forecasts

A Leslie matrix was used to estimate the population for 2005. The advantage of the Leslie matrix is that it projects the size of each age group rather than a total population size (Brown, 1993). Calculation used to predict the Leslie matrix and the population projection are shown in Appendix E. The projected population was then used in each of the forecasting models.

3.10 Chapter Summary

Chapter three described the method used to collect and process A.D.C.I.A. data and outlined the methods used to describe the characteristics of the I.R.C.C. and to

develop and evaluate two forecasting models. The next chapter presents the results of the investigation.

4.0 RESULTS

4.1 Description of Regional Population

The Regional population was greater in 1995 than it was in 1985. In 1988 and 1991, the population was less than in 1985. In general, the population was quite young; over 75% of the population was under the age of 40 (Table F1). Between 1985 and 1995, males made up between 50% and 54% of the Regional population (Table F2). Table F3 shows the Regional population composition by age group and gender. The Dene, Inuit and non-native people were the three largest ethnic groups in the Region, accounting for over 90% of the total population (Table F4). Compared to 1985, in 1995, the proportion of Inuit and Dene increased, whereas the proportion of non-natives decreased.

4.2 Description of I.R.C.C.

The A.D.C.I.A. identified 211 I.R.C.C. in 1985, 205 in 1988, 162 in 1992, and 284 in 1995. Adults (individuals aged 18 years or greater) made up the majority of I.R.C.C. in each year (with a high of 91% in 1991 and a low of 86% in 1995). I.R.C.C. at either level one or two accounted for a minimum of 75% of the total number of I.R.C.C. in each year. Table 2 shows the relative proportion of the levels of need.

Table 2.

Levels of Care of I.R.C.C (1985 - 1995)

Level of Care	1985 n (%)	1988 n (%)	1991 n (%)	1995 n (%)
Adults				
One	104 (49.3)	105 (51.2)	98 (60.5)	141 (49.6)
Two	58 (27.5)	55 (26.8)	42 (25.9)	79 (27.8)
Three	21 (10.0)	25 (12.2)	12 (7.4)	18 (6.4)
Four	4 (1.9)	2 (1.0)	1 (0.6)	8 (2.8)
Children				
One	13 (6.1)	7 (3.4)	4 (2.5)	23 (8.1)
Two	4 (1.9)	4 (2.0)	2 (1.2)	10 (3.5)
Three	7 (3.3)	7 (3.4)	3 (1.9)	5 (1.8)
Total	211 (100)	205 (100)	162 (100)	284 (100)

4.2.1 Age

In general, chronic care need increased with age. Between 1985 and 1995, individuals over the aged 60 and over made up between 5% and 7% of the Regional population. During the same period, however, they accounted for at least 60% of the I.R.C.C. (Table 3).

Table 3.

I.R.C.C. by age group (1985-1995)

Age Group	1985 n (%)	1988 n (%)	1991 n (%)	1995 n (%)
0-19	25 (11.8)	26 (12.7)	16 (9.9)	44 (15.5)
20-39	27 (12.8)	24 (11.7)	19 (11.7)	39 (13.7)
40-59	26 (12.3)	32 (15.6)	23 (14.2)	26 (9.2)
60-79	90 (42.7)	76 (37.1)	66 (40.7)	112 (39.4)
80+	43 (20.4)	47 (22.9)	38 (23.7)	63 (22.2)
Total	211 (100)	205 (100)	162 (100)	284 (100)

Table 4 shows that the number of I.R.C.C per 100 people varied in all age groups between 1985 and 1995. The highest rate was in the 80 years or more age group. The rate also increased over time; the rate was higher in 1995 than it was in 1985 in all age groups except for the 40 to 59 years cohort.

Table 4.

Age Group Specific Rate (number of I.R.C.C. per 100 people)

Age Group	1985	1988	1991	1995
0-19	0.70	0.64	0.54	0.54
20-39	0.76	0.81	0.62	1.16
40-59	1.96	2.25	1.61	1.54
60-79	21.13	15.38	15.42	21.71
80+	55.13	71.79	55.88	75.90

4.2.2 Gender

Table 5 shows the I.R.C.C. by gender. Between 1985 and 1995 the proportion of male I.R.C.C. decreased and the proportion of female I.R.C.C. increased.

Table 5.

I.R.C.C. by gender (1985 - 1995)

Age Group	1985 n (%)	1988 n (%)	1991 n (%)	1995 n (%)
Male	111 (52.6)	102 (49.8)	75 (46.3)	128 (45.1)
Female	100 (47.4)	104 (50.2)	87 (53.7)	156 (54.9)
Total	211 (100)	205 (100)	162 (100)	284 (100)

Although males outnumbered females in the general population between 1985 and 1995, females had a higher rate of requiring chronic care (Table 6). The difference between the two rates has grown since 1985.

Table 6.

Gender specific rate (number of I.R.C.C. per 100 people)

Gender	1985	1988	1991	1995
Males	2.34	2.17	1.87	2.60
Females	2.39	2.43	2.17	3.53

Variability in the total number of I.R.C.C. for each gender can be explained, to a large degree, by the variability of the rates in the 60 to 79 and 80

and over age groups. Table 7 shows that the largest differences in rates occurred in these two age groups.

Table 7.

Gender-age group specific rates (number of I.R.C.C. per 100)

Age Group	1985	1988	1991	1995
Male				
0-19	0.74	0.59	0.50	1.27
20-39	1.02	0.88	0.63	0.94
40-59	1.91	2.22	1.51	1.60
60-79	15.93	11.06	11.01	18.73
80+	62.79	78.57	62.50	64.71
Female				
0-19	0.65	0.69	0.57	1.15
20-39	0.48	0.74	0.60	1.41
40-59	2.06	2.28	1.74	1.46
60-79	27.00	19.91	20.0	24.90
80+	45.71	72.22	50.0	83.67

4.2.3 Ethnicity

Although the Dene, Inuit and non-native groups made up approximately equal proportions of the Regional population, the Dene and Inuit made up considerably larger proportions of I.R.C.C. (Table 8). The rate for non-natives was three times greater in 1995 than it was in 1985. The rate for the Metis was almost four times as greater in 1995 than in 1985 (this calculation, however, is based on a very small number of I.R.C.C. and may not represent a stable rate).

Table 8

I.R.C.C. by ethnicity (1985 - 1995)

Age Group	1985 n (%)	1988 n (%)	1991 n (%)	1995 n (%)
Dene	144 (68.2)	126 (61.5)	89 (54.9)	155 (54.6)
Inuit	57 (27.0)	63 (30.7)	52 (32.1)	93 (32.7)
Non-native	9 (4.3)	15 (7.3)	20 (12.4)	32 (11.3)
Metis	1 (0.5)	1 (0.5)	1 (0.6)	4 (1.4)
Total	211 (100)	205 (100)	162 (100)	284 (100)

The Dene had the highest group specific rate (Table 9). The rates increased for all groups. Age-gender group rates for each ethnic group was not calculated because, population composition by age, ethnicity and gender was not available, and further analysis was not possible.

Table 9.

Ethnic groups specific rate (number of I.R.C.C per 100 people)

Ethnic Group	1985	1988	1991	1995
Dene	5.15	4.58	3.14	5.21
Inuit	2.34	2.22	2.09	3.26
Non-native	0.29	0.59	0.85	0.88
Metis	0.16	0.12	0.13	0.58

4.2.4 Cause of Disability or Chronic Illness

Table 10 shows the number and proportion of I.R.C.C. reporting each cause of disability or chronic illness. Note in each A.D.C.I.A. year, the

percentages do not add to 100 because more than one cause of disability or chronic illness may have been reported for each I.R.C.C.

Table 10.

Causes of disability and chronic illness reported by I.R.C.C.

Cause	1985 n (%)	1988 n (%)	1991 n (%)	1995 n (%)
Diseases of the circulatory system	24 (11.4)	28 (13.7)	25 (15.4)	64 (22.5)
Diseases of the musculoskeletal system	32 (15.2)	39 (19.0)	47 (29.0)	105 (37.0)
Diseases of the respiratory system	19 (9.0)	18 (8.8)	24 (14.8)	53 (18.7)
Mental disorders	47 (22.3)	45 (22.0)	29 (17.9)	54 (19.0)
Congenital abnormalities	11 (5.2)	12 (5.9)	11 (6.8)	36 (12.7)
Diseases of the digestive system	5 (2.4)	5 (2.4)	4 (2.5)	17 (6.0)
Diabetes	8 (3.8)	6 (2.9)	3 (1.9)	13 (4.6)
Paralysis	14 (6.6)	13 (6.3)	9 (5.6)	18 (6.3)
Multiple sclerosis	0	1 (0.5)	0	0
Cerebral palsy	2 (0.9)	3 (1.5)	3 (1.9)	8 (2.8)
Seizure disorders	9 (4.3)	11 (5.4)	10 (6.2)	18 (6.3)
Hearing problems	17 (8.1)	15 (7.3)	12 (7.4)	32 (11.3)
Vision problems	14 (6.6)	15 (7.3)	17 (10.5)	41 (14.4)
Other	100 (47.4)	89 (43.4)	66 (40.7)	72 (25.4)
Frailty	76 (36.0)	67 (32.7)	43 (26.5)	28 (9.6)

Frailty due to age was the most common entry in the "Other" category.

Between 1985 and 1995, the leading causes of disability were: (a) frailty - reported for a mean of 26.2% of the I.R.C.C., (b) diseases of the musculoskeletal system - reported for a mean of 25.1% of the I.R.C.C., (c) mental disorders - reported for a mean of 20.3% of the I.R.C.C., (d) diseases of the circulatory system - reported

for 15.8% of the I.R.C.C., and e) diseases of the respiratory system - reported for a mean of 12.8% of the I.R.C.C.

The most commonly reported diseases of the circulatory system was heart disease (Table F5). Chronic obstructive pulmonary disease (C.O.P.D.) was the most commonly reported disorder of the respiratory system, and arthritis was the most commonly reported disease of the musculoskeletal system. Between 1985 and 1995, only three cases of Alzheimer's disease were reported (all three cases were reported in 1995). The number of F.A.S.⁹ cases in 1995 was seven times greater than the number of cases in 1985. Between 1985 and 1995, the proportion of I.R.C.C reporting more than one cause of disability increased (Table F6).

4.2.5 Socio-economic Factors

Tables F7, F8 and F9 show the values of the four indicators included in the model and the percentage of I.R.C.C. in the total population for each community. Between 1985 and 1991, the percentage of I.R.C.C. in each population remained fairly constant regardless of the unemployment rate. Norman Wells and Inuvik showed a smaller percentage of I.R.C.C. and lower unemployment rates, but both these communities have comparatively high proportions of non-aboriginal people. Moreover, the unemployment rate included only those people who were in the labour force (individuals over the age of 15 who were either employed or seeking employment). Many of the I.R.C.C. in the Region may not have been part of the labour force because of their age or disability.

⁹ Fetal Alcohol Effects (F.A.E.) was counted in the same category as F.A.S.

The percentage of I.R.C.C. decreased as mean annual income increased but when Inuvik and Norman Wells were not considered, the trend was not as clear. Moreover, because this statistic is based on income stated on tax returns, it may not reflect actual income, and thus may not be a reliable indicator of actual income.

In communities with predominantly aboriginal populations, between 60% and 71% of the population had less than a grade 12 education, far more than communities with large non-aboriginal populations. Even when Inuvik and Norman Wells were not included in the analysis, there was not a clear trend between educational attainment and the percentage of I.R.C.C. in the population.

With regard to housing, previous studies indicated that non-institutionalized disabled individuals were more likely to live alone than other Canadians (Ross and Shillington, 1990; Social Trends Directorate, 1986). Although there was a positive correlation between the percentage of I.R.C.C. in the population and the percentage of the population with only one person per household, the same trend is seen with the percentage of I.R.C.C. in the population, and the percentage of the population with six or more people per household.

4.3 Model A

Table 11 contains the results of the multivariate linear regression for each A.D.C.I.A year¹⁰. The table shows which independent variables were initially

¹⁰ Calculations used to develop Model A are described in Appendix C.

included in each year, the variables which were removed after bivariate analysis, as well as the variables in the final regression equation.

The 1991 regression equation posed an additional challenge because there were more variables than there were communities. Because of the poor relationship between socio-economic variables and the percentage of I.R.C.C. in the population, the socio-economic variables were removed from the model to decrease the number of independent variables.

Table 11.

Regression Coefficients and Model Statistics for Model A

Independent Variables	1985	1988	1991	1995
Age				
% pop. 0-19	2.7060*	+	+	+
% pop. 20-39	+	-	-	-
% pop. 40-59	+	-	-	+
% pop. 60-79	+	-	-	-
% pop. 80+	+	-	1.1890*	1.4352*
Gender				
% pop. male	-	-	+	-
Ethnicity				
% pop. Dene	-	-	-	-
% pop. Inuit	-0.3834*	+	-	-
% pop. Non-native	+	-	-	-
Economic				
Mean annual income	x	-	-	x
Unemployment rate	+	0.0301	-	x
Education				
% pop. < grade 12	x	x	-	x
Housing				
% pop. 1/house	x	x	+	x
% pop. 6+/house	x	x	-	x
Model Statistics				
Intercept	-0.9206*	-0.0086	0.0109	0.0191
R ²	0.4988	0.2962	0.751	0.7303
Adjusted R ²	0.3874	0.2258	0.7154	0.7034
* $p \leq 0.05$				
x - not entered into model				
+ - removed after bivariate analysis				
- not significant				

The most consistent predictor was age, particularly the percentage of the population aged 80 years and over. Gender was not a significant predictor in any of the models, and ethnicity was significant in only the 1985 model. Of the socio-economic factors, only unemployment was a significant predictor, but only in the 1988 model.

Each regression equation was evaluated in two ways: how well it fit the data for a given year and how close the predicted values were to actual values of I.R.C.C. The square of the correlation coefficient (R^2) describes the proportion of the variability in the dependent variable which is "explained" by the regression. It evaluates how well the model fits the data for a given year. The adjusted R^2 takes into consideration that a regression model fits the particular data better than it will fit the population. Both measures are indications about the goodness of the fit of the regressions. The R^2 value for 1985 and 1988 models are low, indicating that the models do not fit the data well. For the 1991 and 1995 equations, the R^2 and the adjusted R^2 values were very reasonable, suggesting that the model fit the data well.

In order to evaluate how well the model predicts need, the regression equation from each year was used to estimate the I.R.C.C. for the other A.D.C.I.A. years (Table 12).

Table 12.

Predicted I.R.C.C. values using Model A regression equations

Regression Equation	Estimate Year			
	1985 (n)	1988 (n)	1991 (n)	1995 (n)
1985	-	194	-192	164
1988	-29	-	-25	-
1991	193	190	-	200
1995	263	259	235	-

The regression equation from 1985 underestimated the total number of I.R.C.C. in 1988 and 1995 and produced a negative number for 1991. The 1988 regression equation produced negative values for both 1985 and 1991 estimates. The poor predictions and the low R^2 values indicate that these two regression equations are poor forecasting tools.

The 1991 equation underestimated need and the 1995 equation overestimated it. The data from these two years were pooled to produce another regression equation (Table F10). An additional regression was developed using data from all four years. The regression included only the age variables because of the clear differences in age group specific rates, and because age was the most consistent predictor from the first four regression equations. Because the results of the regression analysis were consistent with the results of the 91/95 pooled regression, and used a larger number of data points, the pooled data equation was used in the Model A predictions (shown in Table 13).

Table 13.

Regression Coefficients and Model Statistics for Pooled Data

Independent Variables	Pooled
Age	
% pop. 0-19	-
% pop. 20-39	-
% pop. 40-59	-
% pop 60-79	0.2966*
% pop. 80+	1.3127*
Model Statistics	
Intercept	-0.0016*
R ²	0.7023
Adjusted R ²	0.6882
* $p \leq 0.05$	
- not significant	

The R² value for the pooled data indicated that the model fits the data reasonably well. Table 14 shows the I.R.C.C. estimates for each year. To determine the number of I.R.C.C. at each level, the mean proportion of I.R.C.C. was calculated using the proportions from each of the four years.

Table 14.

Forecasted number of I.R.C.C using Pooled Data Regression Equations

Level of Care	1985	1988	1991	1995
Adult - One	114	115	111	131
Adult - Two	59	59	56	67
Adult Three	20	20	19	22
Adult Four	3	4	3	4
Child One	11	11	10	12
Child Two	5	5	5	6
Child Three	5	5	5	6
Total	217	219	209	248

In general, the regression model overestimated for 1985, 1988 and 1991 whereas it underestimated for 1995. The I.R.C.C. estimates were evaluated using the five measures shown in Table 15.

Table 15.

Evaluation of Model A estimates

Measure	1985	1988	1991	1995
Mean Absolute Deviation	2.57	4.00	6.71	6.57
Bias	0.86	2.00	6.71	-4.57
Weighted Deviation	0.08	0.13	0.22	0.18
Weighted Bias	0.03	0.06	0.22	0.12
χ^2	2.63	5.89	15.13	20.55
degrees of freedom	6	6	6	6
$\chi^2_{critical}$	10.64	10.64	10.64	10.64

The table shows that, although slightly overestimated, the predictions for the 1985 and 1988 values are quite close to actual values. The Chi square analysis for each of the years showed that the difference between actual and predicted values was not statistically significant. The model overestimated 1991 values whereas it underestimated 1995 values. The difference between predicted and actual values for 1991 and 1995, however, were statistically significant.

4.4 Model B

Model B was used to forecast the number of I.R.C.C. in 1991, given the 1988 data. Calculations used to develop the three year forecast are shown in Appendix D. Table 16 shows the estimate of I.R.C.C. in 1991 as well as the actual 1991 data.

Table 16.

Model B estimate of 1991 I.R.C.C.

Level of Care	1991 estimate	Actual 1991 data
Adult One	94	98
Adult Two	49	42
Adult Three	24	12
Adult Four	1	1
Child One	4	4
Child Two	3	2
Child Three	7	3
Total	182	162

The estimate was evaluated using five measures shown in Table 17. Model B overestimated chronic care need, however, the χ^2 test found that the difference between the actual and forecasted values was not statistically significant.

Table 17.

Evaluation of Model B estimate

Measure	Model B 1991 estimate
Mean Absolute Deviation	4.00
Bias	2.86
Weighted Deviation	0.15
Weighted Bias	0.11
χ^2	9.79
degrees of freedom	6
$\chi^2_{critical}$	10.64

4.5 Need Forecasts

Both Model A and Model B were used to forecast the number of I.R.C.C. in 2005. The pooled regression equation was used for Model A. Similar to the method used to develop a three year matrix, a ten year matrix was tabulated using collected A.D.C.I.A. data. An alternative method of estimating the transition matrix is to multiply the three year transition matrix three times (P^3), to estimate a ten year matrix. The transition matrix used in the 2005 need prediction is shown below:

0.3173	0.1154	0.0288	0	0	0	0	0.1731	0.3354
0.1900	0.2758	0.0344	0	0	0	0	0.1033	0.3695
0	0.0477	0.1904	0.0477	0	0	0	0.0952	0.6190
0.2500	0	0	0	0	0	0	0	0.7500
0.3846	0.0769	0	0	0.0769	0	0	0.4615	0
0	0.2500	0	0	0	0	0	0	0
0	0.1429	0.2857	0.5714	0	0	0	0	0
0.0107	0.0055	0.0008	0.0003	0.0024	0.0011	0.006	0.9447	0.0339
0	0	0	0	0	0	0	0	1

Figure 3. Ten year transition probability matrix.

Using a Leslie Matrix, the 2005 population was projected at 9506, an increase of 224 from 1995 (calculations are explained in Appendix E). Table 18 shows the forecast for I.R.C.C. in 2005 using both Model A and B.

Table 18.

I.R.C.C. forecasts for 2005

Level of Care	Model A	Model B
	n	n
Adult One	265	169
Adult Two	72	95
Adult Three	24	19
Adult Four	4	6
Child One	13	24
Child Two	6	10
Child Three	7	6
Total	265	329

4.6 Chapter Summary

Chapter four presented the results of the study. The next chapter discusses the findings, considers their implication in resource and service planning, and examines limitations of the investigation.

5.0 DISCUSSION

5.1 Description of I.R.C.C.

The description of I.R.C.C. revealed a number of trends about chronic care needs in the Inuvik Region. In general, need increased with age. The highest rate of need was in the 80 or more age group, a finding which is supported by previous studies (Statistics Canada, 1985; Statistics Canada, 1990; Nessner, 1994). Each gender had roughly equal rates of need when differences in age in the cohorts were considered.

The smaller relative proportion of non-native I.R.C.C. and the lower group specific rate confirm suspicions that non-natives collectively had lower chronic care need than Dene and Inuit people. Miles-Tapping (1989) accredited this trend to the "healthy worker effect"; most non-native people resided in the Region because of employment opportunities, and returned to the South once employment ended or chronic illness or disability occurred.

The lower rate among Metis was more difficult to explain. The lower rates among Metis, as well as the relatively small number of Metis in the Regional population may be due to a small number of people claiming Metis status. Between 1985 and 1995, each of the three aboriginal groups (the Inuvialuit, Gwich'in, and Sahtu Dene) had completed or were negotiating land claims. In order to benefit from the land claim (as well as to increase the amount of the settlement) residents may have been more inclined to claim Dene or Inuit status

than Metis. Moreover, status Dene and Inuit enjoyed non-insured health benefits¹¹ and affirmative action policies whereas Metis did not¹².

The disparity in rates between the Inuit and Dene was a potentially important finding. However, further research is required to determine if the higher need in these ethnic groups was due to the age and gender composition of the population.

The overall increase in chronic care need also warrants further examination. The increase may have been due to ageing within each age group which may not have been detected in 20 year age group divisions. The increase in the number of I.R.C.C. (and hence need) may have been due to weaknesses in the data collection methodology or instrumentation (N.W.T.A.P.G.). These potential limitations to the validity of the results are discussed in greater detail later in this chapter.

The causes of disability or chronic illness in the Inuvik Region were somewhat similar to the rest of Canada. Previous Canadian studies found that the leading causes of disability and chronic illness in Canada were (a) diseases of the musculoskeletal system and connective tissue (including limb and joint disorders), (b) diseases of the circulatory system, (c) diseases of the nervous system (including vision and sense disorders), (d) mental disorders, (e) trauma, and (f) diseases of the

¹¹ Non-insured health benefits are health services provided free of charge to status (treaty) Indians, Dene, and Inuit by the Federal Government.

¹² The Territorial Government extended non-insured health benefits to Metis in the fall of 1995.

respiratory system, (g) congenital anomalies and perinatal defects, and (h) diseases of the digestive system (Peron and Strohenger, 1985; Statistics Canada, 1985; Statistics Canada, 1990, Alberta Health 1991)¹³. Frailty, which was the leading cause of disability and illness in the Inuvik Region, was not listed as a specific cause in the surveys used in the other studies and was not reported as a specific cause of disability or chronic illness.

The increase in the number of I.R.C.C. reporting circulatory and musculoskeletal diseases and the decrease in the reporting of frailty may imply that project staff may have better documented cases in 1995 than in 1985. Moreover, increased awareness of some diseases, such as Fetal Alcohol Syndrome (F.A.S.), among key informants and project staff may explain its sudden increase in 1995. This increase also raised questions. F.A.S. results from maternal consumption of alcohol during pregnancy producing multiple features in offspring, including

¹³ When vision and hearing problems are counted in one category (diseases of the nervous system - including sense disorders, the leading causes of disability and chronic illness in the Inuvik region between 1985 and 1995 were: (a) frailty - reported for a mean of 26.2% of the I.R.C.C., (b) diseases of the musculoskeletal system - reported for a mean of 25.1% of the I.R.C.C., (c) mental disorders - reported for a mean of 20.3% of the I.R.C.C., (d) diseases of the nervous system - reported for a mean of 18.2% of the I.R.C.C., (e) diseases of the circulatory system - reported for a mean of 15.8% of the I.R.C.C., and (f) diseases of the respiratory system - reported for a mean of 12.8% of the I.R.C.C.

"microcephaly, pre-natal and post-natal growth deficiencies mental retardation, and facial defects" (Morrison, 1982, 9). A patient afflicted with F.A.S. may demonstrate any combination of the anomalies in varying degrees. F.A.S. is difficult to diagnose conclusively, and reports of F.A.S. in I.R.C.C. may be suspicions rather than confirmed diagnosis (Personal Communication, Margaret Marshall, February 1, 1995), especially in children who reported a milder form of F.A.S., termed Fetal Alcohol Effects (F.A.E.). Children with F.A.E. may exhibit growth deficiency, behavioural problems, and/ or learning disabilities. Children who were "poorly behaved and slow learners" in 1985 may have been suspected of suffering from F.A.S. or F.A.E. in 1995¹⁴.

5.2 Model A

The regression equation used in Model A was based on data from each A.D.C.I.A. year and built upon the information gained from the description of the I.R.C.C. The model fit the data well and produced reasonable estimates for each A.D.C.I.A. year.

Further research, particularly about need in each ethnic group, may produce a more reliable model which uses more specific independent variables. Rather than use the percentage of the population over the age of 80, a refined

¹⁴ In addition to the children identified as requiring care, the 1995 A.D.C.I.A. project staff compiled a list of 208 children who did not meet level one (child) criteria, but were suspected of having F.A.E. (I.R.H.B., 1996b).

model may distinguish the ethnicity of the age group, e.g. the percentage of the population which is Dene and over the age of 80, the percentage of the population which is Inuit and over the age of 80, etc. Moreover, if non-natives and Metis do not contribute significantly to the number of I.R.C.C., forecasts based on the Inuvialuit and Dene population, rather than the total population, may produce more accurate estimates of need.

5.3 Model B

The Markov Chain is a method of forecasting which was readily adaptable to the information available from the A.D.C.I.A. The model was realistic in that it included the possibilities that individuals could be discharged from the system due to improvement in health status or death. However, the model was restricted by a number of assumptions. First, it assumed that the transition probability for all I.R.C.C. was homogeneous; all individuals progressed from state to state at identical rates. It did not account for characteristics which may predispose some individuals to deteriorate at a greater rate than other individuals. Boulton et al. (1991) found that the transition probabilities change depending upon the age, gender and cause of disability of the individuals considered, and recommended developing transition matrices for different groups of I.R.C.C. Further study is required to determine which predisposing factors influence transition probabilities.

Second, the study considered a small sample size, particularly of children and of adults at level three and four in the transition matrix. Additional research

with the data from the other regions in the Northwest Territories may produce more accurate transition probabilities.

Again, additional study about the relationship between ethnicity and need may improve the model. Probabilities for the eighth row (new cases from the population) may be more accurate if they are based on the Inuvialuit and Dene population rather than the total population

5.4 Need Forecasts

Both models depended on population projections in its need forecast. Estimates for future Regional population are variable because the size of the population is highly dependent on economic activities in the Region. The majority on non-native residents would leave the Region if employment opportunities ceased. On the other hand, if oil and gas exploration or mining ventures were further developed, more people (of all ethnic groups) would likely reside in the Region. Finally, estimates for shorter periods of time (e.g. under five years) may provide more reliable, and hence, useful forecasts.

5.5 Implications for Service and Resource Planning

The findings of this study, particularly the description of the I.R.C.C., provide information which may be useful in the planning of services and resources. The majority of the I.R.C.C. were at levels one and two and required homemaking or homecare. Both these services can be organized and provided by community

organizations (in accordance with the Community Wellness policy and the Community Transfer Initiative). However, given the small number of I.R.C.C. that were at level three and four care, institutional and respite care should remain regionally administered programs.

The causes of disability and illness in the Region provide some indication of the types of prevention, therapeutic, and rehabilitation programs required. For example, the increase in the number of suspected F.A.S. cases suggested a need for appropriate assessment and prevention programs. Administrators also need to consider whether there are sufficient resources to prevent and treat diseases of the circulatory, musculoskeletal and respiratory system, as well as mental disorders.

Better understanding the distribution of need in the population can assist in resource allocation. For example, funding formulas can be based on the segments of the population which display need rather than the total population. In the Inuvik Region, the findings suggest that the formulas should consider the number of elderly and the number of Dene and Inuvialuit in the population rather than the total population size without consideration of its composition.

5.6 Potential Limitations to Validity

The validity of the findings of the study depended upon the data collection methodology, the classification instrument, and the statistical models.

5.6.1 Data Collection

A.D.C.I.A. project staff compiled preliminary lists of I.R.C.C. through key informant interviews in each community. Relying on community based informants presents two threats to the validity of the number of I.R.C.C. First, because of familiarity with complaints, health centre staff may have dismissed individuals with minor ailments or minor disabilities, producing false-negative results (Miles-Tapping, 1989). Second, because the A.D.C.I.A. was potentially tied to increased community resources with proven need, some community members may have overstated disability in order to increase community resources, producing false-positives results (Miles-Tapping, 1989). In 1985, homecare and homemaking services were available only in Inuvik. Between 1985 and 1995, the homecare program was expanded in Inuvik and funding was available from the D.O.H.S.S. to contract community based agencies to provide homemaking services, and build long term care facilities in Deline and Inuvik. In 1985, project staff and key informants may have understated need because services (or funding) were not available. In 1995 however, they may have overstated need in order to gain more services and funding. In 1985, project staff were D.O.H.S.S. personnel. In 1995, the project staff were I.R.H.B. personnel, specifically staff from the Homecare department who may have been motivated to justify or increase departmental funding.

Controlling the for variation in key informants over a ten year period may not have been possible as informants may have changed positions or left the

Region. Moreover, research guidelines in the Northwest Territories stipulate that community members should be involved and consulted in all research (Aurora Research Institute, 1996). This is particularly true for research gathered by government agencies (Personal Communication, Drew Lockhart, April 28, 1994).

5.6.2 Instrumentation

Similar methods were not used to classify all I.R.C.C. Those at level two or greater were personally assessed. Individuals at level one (or those considered not disabled by the classification criteria) were assessed by information gathered from care providers and medical charts. The assessor's interpretation of information relating to level of need may vary depending on the source.

Although all assessors used the N.W.T.A.P.G. and identical classification criteria, each assessor may have interpreted the guide differently. Because of the small number of descriptors for each level of care, there was a potential for variability in each assessor's interpretation of the criteria for each level (Personal Communication, Barbara Bracko, January 31, 1996). Although the review by a second party may have reduced the variation in interpretation, individual judgement and assessing styles may have influenced the documentation gathered to support a classification (as well as information which was omitted). The reviewer had access to only the information provided on the client summary charts, and not other information which may have refuted the classification of need.

Additional study is needed to verify if the N.W.T.A.P.G. was a reliable tool for classifications. Modifications to the instrument may be required to reduce potential misinterpretations and to increase the accuracy of the tool.

In its defence however, the data was useful in its original purpose which was to identify and keep record of I.R.C.C. The limitations described above extend from using data which was not collected purposely for this investigation. Future study must specify more rigid data collection protocol to address the limitations outlined above.

5.6.3 Forecasting Models

Both models used small samples which may not have provided stable statistical information. Pooling the data (as in Model A) may have produced more stable coefficients since more data points were used in the regression analysis. Further investigation is required to determine whether the model satisfied the five assumptions of any regression model: linearity¹⁵, normality, homogeneity of variance, independence dependent and independent variables, and elimination of outliers.

For future studies, two alternative models, probit and logit analysis should also be considered. These models are less well-known, but may be more appropriate than the linear model, particularly when the dependent variables are

¹⁵ In order to test for colinearity, forward stepwise regression was performed on Model A (pooled data) and the exact same results were obtained.

proportions as was the case in this study. In 1985 and 1995, the A.D.C.I.A. was carried out in most N.W.T. communities. This provides an excellent opportunity to re-evaluate the models using a larger sample size.

5.7 Chapter Summary

Chapter five discussed the results, their application, and limitations. Final conclusions and recommendations are presented in the next chapter.

6.0 CONCLUSIONS AND RECOMMENDATIONS FOR POLICY MAKERS AND RESEARCHERS

Any planning effort begins with an assessment of need, both present and future. Understanding the needs of a population allows administrators and care providers to plan appropriate services and to allocate resources. Predisposing factors have been used to better understand and forecast needs. The purpose of this study was to gain a better understanding of chronic care need, and to develop and evaluate two forecasting models. The findings of this study provide the basis of a rational planning process.

The findings show that different segments of the population have higher rates of chronic care need than others. Need increased with age and may be more prevalent in Inuvialuit and Dene populations than Metis and non-native populations. Further study is needed to examine the relationship between ethnicity and chronic care need. Trends between chronic care need and socio-economic factors, which have been documented in other Canadian populations, were not found in this population because of the vast difference in socio-economic climates in northern and southern Canada. Additional research is needed to identify appropriate socio-economic indicators in the North.

The study also found that some causes of disability and chronic illness may be more common in the Region than in the rest of Canada. Additional

investigation is required to understand the epidemiology of certain conditions, such as F.A.S.

Both of the models were promising forecasting tools. Replication of the study, with larger samples and greater control over potential limitations will improve the models and increase the reliability of the forecasts. Additional research may also determine if the two models are statistically appropriate. A.D.C.I.A. data were collected for most communities in the Northwest Territories in 1985 and again between 1993 and 1995. This provides an excellent opportunity to test the models using similar chronic care assessment and classification methods.

Future research about chronic care need must develop more rigid guidelines for data collection and classification to gather accurate and reliable assessments of need. Moreover, modifications to the N.W.T.A.P.G. may reduce ambiguity in its application and produce uniform interpretation among its users.

Many of the limitations described in the study resulted from using data which was not originally intended for this investigation. In order to support the evidence-based decision making process, researchers and policy makers must contemplate and clarify the types of information required and how the information can be used. Better information about need will support sound service planning, resource allocation, and policy-making.

BIBLIOGRAPHY

Alberta Health. (1991). Residents of Alberta's Long Term Care Facilities. A Descriptive Profile. Edmonton: Alberta Health.

Anderson, R., & Newman, J.F. (1978). Societal and individual determinants of medical care utilization in the United States. Millbank Memorial Fund Quarterly, 51, 95 - 124.

Angus, D.E. (1995). Sustainable Health Care for Canada: Synthesis Report. Ottawa: Queen's - University of Ottawa Economic Projects.

Aurora Research Institute (1996). Doing Research in the Western Northwest Territories. A Guide for Researchers. Inuvik: Aurora Research Institute Aurora College.

Badley, E.M. & Ibanez, B. (1994). Socioeconomic Risk Factors and Musculoskeletal Disability. Journal of Rheumatology, 21, 515-22.

Benoit, France (ed.) (1995). Community Wellness, working Together for Community Wellness. A Directions Document. Yellowknife: Department of Health and Social Services.

Bienvenue, R.M. & Havens, B. (1986). Structural Inequalities, Informal Networks: A Comparison of Native and Non-Native Elderly. Canadian Journal on Ageing, 5, 241-248.

Bobet, E. (1994). Indian Mortality. In Canadian Social Trends (57- 60). Canada: Thompson Educational Publishing, Inc.

Boult, C., Kane, R.L., Louis, T.A., Ibrahim, J.G. (1991) Forecasting the Number of Future Disabled Elderly Using Markovian and Mathematical Models. Journal of Clinical Epidemiology, 44, 973 - 980.

Brown, Robert L., (1993). Introduction to the Mathematics of Demography (2nd Ed.). Connecticut: Actex Publication Incorporated, 168-176.

Cassou, B., Derriennic, F., Iwatsubo, Y., & Amphoux, M. (1992) Physical disability after retirement and occupational risk factors during working life: a cross sectional epidemiological study in the Paris area. Journal of Epidemiology and Community Health, 46, 506 - 511.

D'Arcy, C. & Siddique, C.M. (1985). Unemployment and Health: An Analysis of "Canada Health Survey Data". International Journal of Health Services, 15, 609 -635.

Department of Health. (1993). Department of Health, Working Together Towards Health For All: The N.W.T. Way, Submission to the Royal Commission on Aboriginal Peoples. Yellowknife: Government of the Northwest Territories.

Department of Health and Social Services. (1996). Health and Social Services Business Plan 1996/97 to 1998/99. Yellowknife: Department of Health and Social Services.

Donabedian, A. (1973). Aspects of Medical care Administration: Specifying Requirements for Health Care. Cambridge: Harvard University Press.

Federal/Provincial/Territorial Subcommittee on Long-Term Care. (1990). Description of Long-Term Care Services in Provinces and Territories of Canada. Ottawa: Health and Welfare Canada.

Grossman D.C., Krieger, J.W., Sugarman, J.R., Forquera, R.A. (1994). Health Status of Urban American Indians and Alaska Natives, A Population Based Study. Journal of the American Medical Association, 271, 845-850.

Government of the Northwest Territories (1987). 1985/86 Assessment Project: Aged Disabled & Chronically Ill Report. Department of Health and Department of Social Services: Yellowknife: Government of the Northwest Territories.

Hamilton, N. and Bhatti, T. (1996). Population Health Promotion: An Integrated Model of Population Health and Health Promotion. Ottawa: Health Promotion Development Division.

Health and Welfare Canada. (1986). Report on the Canadian Health and Disability Survey, 1983-84. Ottawa: Supply and Services Canada.

Health and Welfare Canada. (1988). L'etat de sante des Indiens et les Inuit du Canada [Health Status of Indians and Inuit in Canada]. Ottawa: Supply and Services Canada.

Hennekens, C.H. & Buring, J.E. (1987). Epidemiology in Medicine. Toronto: Little Brown and Company.

Inuvik Regional Health Board. (1996). Inuvik Region Profile of Needs. Inuvik: Inuvik Regional Health Board.

Inuvik Regional Health Board (1996). Inuvik Region Update, Aged Disabled and Chronically Ill. Inuvik: Inuvik Regional Health Board.

Inuvik Regional Health Board (1996). Role Statement. Inuvik: Inuvik Regional Health Board.

Jain, S. (1986). Markov Chain Model and Its Application. Computers and Biomedical Research, 19, 374 - 378.

Jarvis, G.K. & Boldt, M. (1982). Death Styles Among Canada's Indians. Social Science & Medicine, 16, 1345 - 1352.

Kitikmeot Regional Health Board. (1993). Kitikmeot Regional Update and Needs Assessment: Aged Disabled and Chronically Ill. Cambridge Bay: Kitikmeot Regional Health Board.

Lane, D., Uyeno, D., Stark, A., Kliever, E., & Gutman, G. (1985) Forecasting Demand for Long-Term Care Services. Health Services Research, 20, 435 - 460.

Makela, M., Heliovaara, M., Sievers, K., Knekt, P., Maatela, J., Aromaa, A. (1993). Musculoskeletal Disorders as Determinants of Disability in Finns Aged 30 Years or More. Journal of Clinical Epidemiology, 46, 549 - 559.

Manton, K.G., Vertrees, J.C., Clark, R.F. (1993). A Multivariate Analysis of Disability and Health, and its Channelling Demonstration Data. The Gerontologist, 33, 610 - 618.

Mark, D.B., Lam, L.C., Lee, K.L., Clapp-Channing, N.E., Williams, R.B., Pryor, D.B., Califf, R.M., Hlatky, M.A. (1992). Identification of Patients With Coronary Disease at High Risk for Loss of Employment, A Prospective Validation Study. Circulation, 86, 1485 - 1494.

McClure, L. et al, (Eds.). (1992). First Nations Urban Health Bibliography: A Review of the Literature and Exploration of Strategies. Winnipeg: University of Manitoba.

Miles-Tapping, C. (1989). The Aged, Disabled and Chronically Ill in the Northwest Territories: Results of a Needs Assessment Survey. Native Studies Review, 5, 145-161.

Millar, W.J., & Hill G.B (1993). Prevalence of and risk factors for sudden infant death syndrome in Canada. Canadian Medical Association Journal, 149, 629-635.

Monson, R.R. (1986). Observations on the Healthy Worker Effect. Journal of Occupational Medicine, 28, 425-433.

Morrison, H.I. (1982). Fetal Alcohol Syndrome: A Review. In Chronic Disease in Canada, 3, 9-11.

Nessner, K. (1994). Profile of Canadians with Disabilities. In Canadian Social Trends (121-124). Canada: Thompson Educational Publishing, Inc.

Norton, E.C. (1992). Incentive regulation of nursing homes. Journal of Health Economics, 11, 105 - 128.

Peron, Y. & Strohmenger, C. (1985). Demographic and Health Indicators: Presentation and Interpretation. Ottawa: Supply and Services Canada.

Pol, L.G., & Thomas, R.K. (1992). The Demography of Health and Health Care. New York: Plenum Press.

The Repatriation Task Group. (1996). Development of Northern Resources for Special Needs. Yellowknife: Department of Health and Social Services.

Ross, D.P. & Shillington, E.R. (1990). An Economic Profile of Canadians with Disabilities. Ottawa: Supply and Services Canada.

Rubinson, L. & Neutens, J.J. (1987). Research Techniques for the Health Sciences. New York: Macmillan Publishing Company.

Starrett, R.A., Rogers, D., & Walters, G. (1988). Home Health Care Utilization: A Causal Model. Home Health Care Services Quarterly, 9, 125 - 140.

Statistics Canada. (1985). Highlights from the Canadian Health and Disability Survey 1983-1984. Ottawa: Supply and Services Canada.

Statistics Canada. (1986). Report of the Canadian health and disability survey 1983-1984. Ottawa: Supply and Services Canada.

Statistics Canada. (1990). The Health and Activity Limitation Survey, Highlights: Disabled Persons in Canada. Ottawa: Supply and Services Canada.

Social Trends Directorate (1986). Profile of Disabled Persons in Canada. Ottawa: Department of the Secretary of State.

Swain, R.W. (1981). Health Systems Analysis. Columbus: Grid Publishing Inc.

Territorial Hospital Insurance Service Board and The Department of Health. (1990). Health and Health Services in the Northwest Territories. Yellowknife: Government of the Northwest Territories.

Wenzel, S.L., Bakhtiar, L., Caskey, N.H., Hardie, E., Redford, C., Sadler, N., & Gelberg, L. (1995) Homeless Veterans' Utilization of Medical, Psychiatric and Substance Abuse Services. Medical Care, 33, 1132 - 1144.

Ward, R. (1977). Services for older people, an integrated framework for research. Journal of Health and Social Behaviour, 18, 61 - 70.

Wolinsky, F.D. (1978). Assessing the Effects of Predisposing, Enabling, and Illness-Morbidity Characteristics on Health Service Utilization. Journal of Health & Social Behaviour, 19, 384 - 396.

Wolinsky, F.D., Stump, T.E., Johnson, R.J., Hospital Utilization Profiles Among Older Adults Over Time: Consistency and Volume Among Survivors and Descendants. Journal of Gerontology, Social Sciences, 50B, S88 - S100.

Young, David E., (Ed.) (1988). 52VHealth Care Issues in the Canadian North. Edmonton: Boreal Institute for Northern Studies.

APPENDIX A

NORTHWEST TERRITORIES ASSESSMENT AND PLACEMENT GUIDE



ASSESSMENT AND ACTION RECORD

Department of Health and Department of Social Services

Northwest Territories

AGENCY COMPLETING
ASSESSMENT:

LOCATION:

DATE:

1 2 3 4 5 6 7 8 9 10 11 12

NAME		Surname		Given Name(s)	
ADDRESS					
DATE OF BIRTH		Day Month Year		PHONE NO.	
MARITAL STATUS		Single Married		Other (specify) —	
LANGUAGE(S) SPOKEN		LANGUAGE(S) WRITTEN			
OCCUPATION		HEALTH CARE NO.			
FAMILY MEMBERS CLOSE FRIENDS — Check (✓) person responsible for client. Note — If none, enter "NONE" in space.					
✓	NAME	NAME ADDRESS PHONE NO.	DISTANCE CONTACT FREQUENCY	SUPPORTIVENESS OF CLIENT AND HOW	
	ADDRESS PHONE NO.				
	NAME				
	ADDRESS PHONE NO.				
	NAME				
	ADDRESS PHONE NO.				
	NAME				
	ADDRESS PHONE NO.				
Comments					

SUMMARY OF CLIENT PLACEMENT — Complete after assessment

☐ LEVEL 1
SUPERVISORY CARE — Client is essentially independent and shows only a slight impairment (physical frailty and/or minor mental deterioration).
Care required — mainly guidance or supervision with activities of daily living.

☐ LEVEL 2
PERSONAL CARE — Client shows impairment of physical and/or mental facilities.
Care required — supervision and assistance with activities of daily living (eg. hygiene and grooming, meals, laundry, and housekeeping services).
— Client gets around safely with or without aids, is able to feed him/herself and is usually continent.
— This is 24 hour custodial care and may be provided in an extended family/foster home with support services, adult residential care facility, or personal care home.

☐ LEVEL 3
NURSING HOME — Client has advanced physical and/or mental illness that is reasonably stabilized and not expected to deteriorate in the near future (barring an accident or additional disease).
Care required — Nursing home facility.

☐ LEVEL 4
EXTENDED/CHRONIC CARE — Client who requires regular and continuous medical attention, highly skilled technical nursing supervision on a 24 hour basis, and special techniques for improvement and/or maintenance of function.
Care required — Chronic care facility with access to diagnostic/treatment facilities.

☐ LEVEL 5
INTENSIVE REHABILITATION CARE — Client with physical disabilities who requires intensive therapy.
Care required — Special rehabilitation team.
— Maximum benefit should probably occur within 3 months, at which time the client is transferred home or to another facility for a more appropriate level of care.

☐ LEVEL 6
ACUTE CARE — Client (all ages) who requires short term diagnosis and treatment.
Care required — 24 hour medical nursing supervision in specialized hospitals.
— Outpatient services and day hospitals for mental illness are also included.

SERVICE SUGGESTED

☐ Home
☐ Independently
☐ Other (specify) —

☐ Home with Family Support
☐ Home with Community Service
☐ Appropriate Care Facility

IMPORTANT — enter "x" beside the applicable assessment.

A. ACTIVITIES OF DAILY LIVING

	REASSESSMENT DATES - Day/Month/Year			
	Initial Assessment	Final Goal		
1. LOCOMOTION				
Climbs stairs				
Commands starts with assistance				
Walks independently				
Walks with aid				
Walks with assistance				
Wheelchair				
Wheelchair with assistance				
Stairlift				
2. TRANSFERS (bed chair, shower, toilet, etc.)				
Fully independent				
Independent with devices				
Requires assistance				
Totally dependent				
3. FEEDING				
Fully independent				
Independent with modifications				
Requires supervision only				
Requires assistance				
Totally dependent				
4. DRESSING				
Fully independent				
Independent with modifications				
Requires supervision				
Requires assistance				
Totally dependent				
5. GROOMING (wash face, shave, manicure, hair, etc.)				
Fully independent				
Independent with devices				
Requires supervision only				
Requires assistance				
Totally dependent				
6. NAIL CARE				
Cut nails				
Requires assistance				

ACTIVITIES OF DAILY LIVING COMMENTS

7. BATHING				
Fully independent				
Independent with devices				
Requires supervision only				
Requires assistance				
Totally dependent				
8. TOILET USE (transfer, commode, urinal, etc.)				
Fully independent				
Independent with modifications				
Requires supervision only				
Requires assistance				
Totally dependent				
9. HAND USE (grip, strength, dexterity)				
Fully independent				
Independent with tremor				
Independent with adaptations				
Requires assistance				
Totally dependent				

B. TRAVEL

1. ABILITY TO TRAVEL				
Fully independent				
Requires transfer assistance				
Uses public transport alone				
Needs special transport (wheelchair cab, etc.)				

TRAVEL COMMENTS: Indicate any special transportation requirements.

C. HOUSEHOLD ACTIVITIES

	Initial Assessment	Final (Goal)	REASSESSMENT DATES - Day/Month/Year											
1. PREPARING MEALS														
Fully independent														
Independent with modifications														
Required assistance available														
Assistance required														
Not applicable														
2. DISHES (wash/dry)														
Fully independent														
Independent with modifications														
Required assistance available														
Assistance required														
Not applicable														
3. LIGHT HOUSEWORK (dust, vacuum, etc.)														
Fully independent														
Independent with modifications														
Required assistance available														
Assistance required														
Not applicable														
4. MAKING BEDS														
Fully independent														
Independent with modifications														
Required assistance available														
Assistance required														
Not applicable														
5. LAUNDRY														
Fully independent														
Independent with modifications														
Required assistance available														
Assistance required														
Not applicable														
6. YARD WORK														
Fully independent														
Independent with modifications														
Required assistance available														
Assistance required														
Not applicable														
7. HOME REPAIRS														
Fully independent														
Independent with modifications														
Required assistance available														
Assistance required														
Not applicable														
8. HEATING (include coal, wood, oil, etc.)														
Fully independent														
Independent with modifications														
Required assistance available														
Assistance required														
Not applicable														
9. SHOPPING														
Fully independent														
Independent with modifications														
Required assistance available														
Assistance required														
Not applicable														
10. BUDGETING, BANKING														
Fully independent														
Independent with modifications														
Required assistance available														
Assistance required														
Not applicable														
11. ERRANDS														
Fully independent														
Independent with modifications														
Required assistance available														
Assistance required														
Not applicable														
12. ABLE TO USE														
Light switches														
Faucets														
Telephone														
TV, radio channels														
Thermosets														

HOUSEHOLD ACTIVITIES COMMENTS

D. MEDICAL-BIOLOGICAL

		REASSESSMENT DATES - Day/Month/Year					
	Initial Assessment	Final Goal					
1. VISION	Normal						
	Normal with glasses/lenses						
	Limited vision						
	Totally blind						
2. HEARING							
	Normal						
	Normal with aid						
	Partially impaired Deaf						
3. ABILITY TO COMMUNICATE	Speech normal						
	Speech impaired but intelligible						
	Speech barely intelligible						
	Speech unintelligible, uses gestures Does not communicate at all						
4. COMPREHENSION	Normal						
	Partial comprehension of speech						
	Unable to comprehend speech						
	Unable to comprehend speech/gesture Unable to assess						
5. DENTITION	Adequate						
	Some problem						
	Major problem						
6. DIET	Normal						
	Soft						
	Therapeutic						

[illegible]

MEDICAL BIOLOGICAL COMMENTS: Indicate any past or present medical problems, treatments, medications, etc.

E. PSYCHO-SOCIAL *NOTE

		REASSESSMENT DATES - Day/Month/Year			
	Initial Assessment				
1. MEMORY & ORIENTATION					
Normal					
Periods of forgetfulness, confusion, disorientation					
Constantly confused & disoriented					
2. MOOD STATUS					
Depressed — no problem					
Depressed — moderate problem					
Depressed — extreme problem					
Anxious — no problem					
Anxious — moderate problem					
Anxious — extreme problem					
Uncooperative — no problem					
Uncooperative — moderate problem					
Uncooperative — extreme problem					
3. IN JUDGEMENT					
Normal					
Limited ability					
Unable to make any judgement					
4. ATTITUDE TO DISABILITY & LIMITATIONS					
Accepts, participates in planning care					
Accepts, but poor motivation to improve					
Denies limitations					
Unable to cope					
5. FAMILY RELATIONSHIPS — EMOTIONAL SUPPORT (Observed)					
Adequate support from family					
Some support from family					
No support from family					
Family a negative factor					
No family					

*Obtain PSYCHO-SOCIAL assessment from observation, patient, and family if possible. If there is not adequate time to evaluate at the initial assessment, complete on a subsequent visit, stating the date.

6. SOCIAL RELATIONSHIPS OUTSIDE FAMILY					
Attends outside social functions					
Participates socially at home					
One or two close friends					
Infrequent contact with outsiders					
No friends or social activities					
7. INITIATIVE IN PARTICIPATING IN SOCIAL ACTIVITIES					
High					
Moderate					
Low					
None					
8. USE OF LEISURE					
Takes initiative, makes good use					
Engages in leisure only with persuasion					
No active use of leisure					
9. BEREAVEMENT					
No recent bereavement					
None within last year					
Occurred within last month					

PSYCHO-SOCIAL COMMENTS: (Specify date)

LIVING ARRANGEMENT OF CLIENT		CLIENT INFORMATION	
TYPE OF ACCOMMODATION ☐ Alone ☐ Spouse ☐ with Relatives ☐ with Children ☐ Other — (specify) ☐ NO OF ADULTS ☐ NO OF CHILDREN		CLIENT UNDERSTANDS THE SITUATION ☐ Fully ☐ Partly ☐ Poorly ☐ Not at all	
FACILITIES — HEAT ☐ Oil ☐ Gas ☐ Wood ☐ Other — (specify)		CLIENT PERSONALLY PROVIDED THE INFORMATION RECORDED ON THIS FORM ☐ YES ☐ NO (If NO, specify)	
FACILITIES — WATER ☐ Running ☐ Hot ☐ Cold ☐ Storage Tank ☐ Truck ☐ Self-Supply ☐ Others — (specify)		CLIENT PRESENTLY RECEIVES HOME CARE OR SUPPORT SERVICES ☐ YES ☐ NO (If YES, specify)	
FACILITIES — BATH/SHOWER ☐ Bath — Yes ☐ Bath — No ☐ Shower — Yes ☐ Shower — No		CLIENT AGREES WITH INFORMATION RECORDED ON THIS FORM ☐ YES ☐ NO (If NO, specify)	
FACILITIES — TOILET ☐ Indoors ☐ Outdoors ☐ None		CLIENT AGREES TO MOVE TO APPROPRIATE CARE FACILITY IF NECESSARY Totally ☐ Accepting ☐ Accepting ☐ Indecisive ☐ Unaccepting Fairly	
COMMENTS (specify date)		CLIENT ASSESSED AGREES WITH RECOMMENDED SERVICES IF NOT, EXPLAIN:	

ASSESSMENT COMPLETED BY:

NAME

Signature

Date

ADDRESS

PHONE NO.

Business

Residence

OCCUPATION

APPENDIX B

DATA ENTRY FORM.

Data Entry Form

YEAR	COMMUNITY	HCP	ETHNICITY	BIRTH	SEX	
CIRCULATORY	MUSCULOSKELETAL	RESPIRATORY	MENTAL	CONGENITAL		
HEART DISEASE	ARTHRITIS	ASTHMA	ALZHEIMERS	DOWN'S		
HYPERTENSION	RHEUMATISM	COPD		FAS		
DIGESTIVE	DIABETES	MS	EPILEPSY	PARALYSIS	CP	BLIND
DEAF						
OTHER						
LEVEL OF NEED						

APPENDIX C

MODEL A: CALCULATIONS

Model A used multivariate linear regression to forecast the percentage of I.R.C.C. in the community population. The regression coefficients are displayed in Table 13. The regression equation for Model A is:

$$\hat{y} = \beta_1 x_1 + \beta_2 x_2 + \dots + c$$

where

$\hat{y}$ = estimate of percentage of I.R.C.C. (dependent variable)

β_1 = coefficient of the first independent variable

x_1 = first independent variable

β_2 = coefficient of the second independent variable

x_2 = second independent variable

c = constant.

The pooled data coefficients were used to predict the percentage of I.R.C.C. in each year. The values for the independent variables are shown in Table 3, Table 5, and Table 8. A sample calculation for 1985 was:

$$\hat{y} = 0.2966 (\% \text{ pop. } 60-79) + 1.3127 (\% \text{ pop. } 80) - 0.0016$$

$$\hat{y} = 0.0243$$

To calculate the predicted number of I.R.C.C in 1985, this number was multiplied by the total 1985 population:

$$0.0243 \times 8933 = 217 \text{ I.R.C.C.}$$

To calculate the number of I.R.C.C. at each level of care, this number was multiplied by the mean proportion of I.R.C.C. at each level in between 1988 and 1995 (shown in Table 2). For example, to calculate the number of I.R.C.C at level one

$$217 \times \text{mean \% I.R.C.C. at level one} =$$

$$217 \times 0.538 = 117.$$

APPENDIX D

MODEL B: CALCULATIONS

Model B used a Markov Chain transition matrix to forecast need. The A.D.C.I.A. data from 1985 and 1988 were used to predict the I.R.C.C for 1991. To develop the Markov Chain, the levels of care of I.R.C.C. were recorded in 1985 and 1988. In 1985, each person in the population was classified into one of seven levels of care, or as not requiring care. In 1988, they were counted in one of nine categories: (a) adult - level one, (b) adult - level two, (c) adult - level three, (d) adult - level four, (e) child - level one, (f) child - level two, (g) child - level three (h) alive and no longer requiring chronic care services, or (i) dead. Table D1 shows level of care of the 1985 population 1988.

Table D1.

Levels of Care of 1985 Population in 1988

Level of Care	1988								
	Adult One n	Adult Two n	Adult Three n	Adult Four n	Child One n	Child Two n	Child Three n	Alive - No Care n	Dead n
1985 Adult One	73	5	1	0	0	0	0	13	12
Adult Two	9	38	1	0	0	0	0	4	6
Adult Three	0	3	9	0	0	0	0	1	6
Adult Four	1	1	0	1	0	0	0	0	1
Child One	5	0	0	0	6	1	0	1	0
Child Two	0	1	0	0	0	2	0	1	0
Child Three	0	0	2	0	0	0	5	0	0
No Care	17	7	10	1	1	1	2	8608	75

The probability of transferring from one state to another were calculated and entered into the matrix shown below:

0.7019	0.0481	0.0096	0	0	0	0	0.1250	0.1154
0.1552	0.6552	0.0172	0	0	0	0	0.0690	0.1034
0	0.1429	0.5238	0	0	0	0	0.0476	0.2857
0.2500	0.2500	0	0.2500	0	0	0	0	0.2500
0.3846	0	0	0	0.4615	0.0769	0	0.0769	0
0	0.2500	0	0	0	0.5000	0	0.2500	0
0	0	0.2857	0	0	0	0.7143	0	0
0.0019	0.0008	0.0011	0.0001	0.0001	0.0001	0.0002	0.9869	0.0088
0	0	0	0	0	0	0	0	1

The ninth row, death, is an absorbing state; once individuals transfer to the state, they remain there.

Matrix A is a nine by one matrix. The first seven elements are the number of I.R.C.C. at each level of care in 1985. The eighth element is the number of people who did not require chronic care and the ninth element is the number of dead at the beginning of the transition period.

$$A = \begin{bmatrix} 97 \\ 52 \\ 22 \\ 2 \\ 7 \\ 3 \\ 7 \\ 7802 \\ 0 \end{bmatrix}$$

Because Sachs Harbour, Tsiigehtchic, and Paulatuk were not included in the 1991 data, they were not include in this calculation, hence the discrepancy between these figures and the figures reported elsewhere.

The two matrices are multiplied according to the formula $A^T \times P$ to produce Matrix B:

$$A^T \times P = B = \begin{bmatrix} 94 \\ 49 \\ 24 \\ 1 \\ 4 \\ 3 \\ 7 \\ 7718 \\ 92 \end{bmatrix}$$

The entries in Matrix B describe the level of care of the 1988 I.R.C.C in 1991. The first entry is the number of I.R.C.C. in level one, the second the number of people at level two, etc. The eighth entry is the number of 1988 people who do no require chronic care services. The ninth entry is the number of people who died.

APPENDIX E

LESLIE MATRIX: CALCULATIONS

To project the population, two matrices, K and M, were multiplied together according to the formula $M^z K$, where

$$z = \frac{\text{number of years ahead}}{\text{interval limit.}}$$

The subscript in each matrix represents the interval number.

Matrix K is the population vector

$$K = \begin{bmatrix} k_i \\ k_{2i} \\ k_{3i} \\ \vdots \\ k_{ni} \end{bmatrix}$$

where i is the interval and each entry in the number of people in each interval.

Matrix M is the Leslie matrix.

$$M = \begin{bmatrix} a_1 & a_2 & \cdots & a_{n-1} & a_n \\ b_1 & 0 & \cdots & 0 & 0 \\ 0 & b_2 & \cdots & 0 & 0 \\ \vdots & \vdots & \ddots & \vdots & \vdots \\ 0 & 0 & \cdots & b_n & 0 \end{bmatrix}$$

where

$$a_i = \frac{L_i}{l_i} \left[\frac{1}{2} f_i + \frac{1}{2} (b_i) (f_i) \right]$$

L_i = number of people in interval (males and females)

l_i = number of females in interval

f_i = interval specific birth rate of females

$$b_i = \frac{L_{i+1}}{L_i}$$

In order to calculate 10 years into the future, from 1995 to 2005, the Regional population was divided into ten year intervals. In order to calculate the ten year

interval specific birth rate of female offspring, a mean of the 1988 to 1992 birth rates was calculated and projected for a ten year period. Table E1 shows the values used to calculate the population in 2005, shown in table E2.

Table E1.

Values for Population Projection

Interval i (age group)	L_i	I_i	f_i	a_i	b_i
1 ((0-9)	2112	1019	0	0	0.72
2 (10-19)	1514	721	0.02	0.04	1.08
3 (20-29)	1628	780	0.03	0.07	1.11
4 (30-39)	1820	857	0.02	0.03	0.59
5 (40-49)	1065	462	0	0	0.59
6 (50-59)	625	289	0	0	0.56
7 (60-69)	352	159	0	0	0.45
8 (70-79)	157	83	0	0	0.4
9 (80-89)	63	37	0	0	0.32
10(90-99)	20	11	0	0	0.05
11 (100-109)	1	1	0	0	0

Table E2.

Projected 2005 Population for the Inuvik Region

Age Group	Estimated population	Per cent of population
0-19	3823	40.2
20-39	3410	35.7
40-59	1674	17.6
60-79	527	5.5
80+	92	1.0
Total	9506	100

Table F1.

Age group composition of the Inuvik Region population, 1985 - 1995.

Age Group	1985 n (%)	1988 n (%)	1991* n (%)	1995 n (%)
0-19	3572 (40.0)	3461 (39.3)	2982 (37.3)	3623 (39.0)
20-39	3541 (39.6)	3444 (39.1)	3086 (38.6)	3370 (36.3)
40-59	1316 (14.7)	1379 (15.7)	1428 (17.8)	1690 (18.2)
60-79	426 (4.8)	442 (5.0)	428 (5.4)	516 (5.6)
80+	78 (0.9)	78 (0.9)	68 (0.9)	83 (0.9)
Total	8933 (100)	8804 (100)	7992 (100)	9282 (100)

* Does not include Paulatuk, Sachs Harbour, and Tsiigehtchic

Table F2.

Gender composition of the Inuvik Region population, 1985-1995.

Gender	1985 n (%)	1988 n (%)	1991* n (%)	1995 n (%)
Male	4753 (53.2)	4719 (53.6)	4031 (50.4)	4934 (53.2)
Female	4180 (46.8)	4085 (46.4)	3961 (49.6)	4348 (46.8)
Total	8933 (100)	8804 (100)	7992 (100)	9282 (100)

* Does not include Paulatuk, Sachs Harbour, and Tsiigehtchic

Table F3.

Population composition of the Inuvik Region by age and gender, 1985-1995

Female	1985	1988	1991*	1995
0-19	1690	1591	1576	1740
20-39	1673	1629	1508	1559
40-59	582	613	631	751
60-79	200	216	210	249
80+	35	36	36	49
Sub-total	4180	4085	3961	4348
Male				
0-19	1882	1870	1406	1883
20-39	1868	1815	1578	1811
40-59	734	766	797	939
60-79	226	226	218	267
80+	43	42	32	34
Sub-total	4753	4719	4031	4934
Total	8933	8804	7992	9282

* Does not include Paulatuk, Sachs Harbour, and Tsiigehtchic.

Table F4.

Ethnic composition of Inuvik Region Population, 1985-1995

Ethnic Group	1985 n (%)	1988 n (%)	1991* n (%)	1995 n (%)
Dene	2751 (30.8)	2700 (30.6)	2673 (33.4)	2955 (31.8)
Inuit	2423 (27.1)	2785 (31.6)	2347 (29.4)	2834 (30.5)
Non-native	3140 (35.2)	2483 (28.2)	2234 (28.0)	2810 (30.3)
Metis	619 (6.9)	836 (9.6)	738 (9.2)	683 (7.4)
Total	8933 (100)	8804 (100)	7992 (100)	9282 (100)

* Does not include Paulatuk, Sachs Harbour, and Tsiigehtchic

Table F5.

Specific causes of disability and chronic illness

Cause	1985	1988	1991	1995
Circulatory Disease	24	28	25	64
Heart Disease	13	8	6	26
Hypertension	5	4	3	22
Musculoskeletal Disease	32	39	47	105
Arthritis	17		31	74
Rheumatism	1	0	3	3
Respiratory Disease	19	18	24	53
C.O.P.D.	16	16	22	42
Asthma	0	1	1	1
Mental Disorders	47	45	29	54
Alzheimer's Disease	0	0	0	3
Congenital Disorders	11	12	11	36
Down's Syndrome	3	4	4	6
F.A.S.	4	3	2	21

Table F6.

Number of reported causes of disability and chronic illness

Number of reported causes of disability or chronic illness	1985 n (%)	1988 n (%)	1991 n (%)	1995 n (%)
One	138 (65.4)	134 (65.4)	90 (55.6)	129 (45.4)
More than one	73 (34.6)	71 (34.6)	72 (44.4)	155 (54.6)
Total	211 (100)	205 (100)	162 (100)	284 (100)

Table F7.

Unemployment and Percentage of I.R.C.C. in the population, 1985

Community	I.R.C.C. in population (%)	Unemployment Rate (%)*
Aklavik	3.5	39
Colville Lake	16.0	34
Deline	7.0	20
Fort Good Hope	5.4	24
Fort McPherson	1.9	31
Inuvik	0.8	11
Norman Wells	0.8	8
Paulatuk	0.4	29
Sachs Harbour	2.5	17
Tsiigehtchic	4.4	-
Tuktoyaktuk	2.0	33
Tulita	5.5	8

* % of the labour force

Table F8.

Socio-economic Indicators and Percentage of I.R.C.C. in the population, 1988

Community	I.R.C.C. in the population (%)	Unemployment Rate (%)*	Mean Annual Income (\$)
Aklavik	2.4	42	16 239
Colville Lake	14.2	20	8 050
Deline	6.6	22	14 000
Fort Good Hope	4.1	17	14 374
Fort McPherson	1.2	35	14 828
Inuvik	1.1	6	27 983
Norman Wells	0.7	7	36 106
Paulatuk	0.9	18	11 386
Sachs Harbour	1.9	16	21 200
Tsiigehtchic	8.2	40	12 360
Tuktoyaktuk	2.5	31	19 158
Tulita	5.1	13	19 158

* % of the labour force

Table F9.

Socio-economic Indicators and Percentage of I.R.C.C. in the population, 1991

Comm nity	I.R.C.C. in the population (%)	Unemployment Rate (%)*	Mean Annual Income (\$)	Less than grade 12**	1/house**	6+/house**
Aklavik	2.1	37	19 690	61.5	16.7	16.7
Colville Lake	8.5	40	12 333	67.7	25	25
Deline	4.5	21	18 044	71.2	18.5	29.6
Fort Good Hope	3.3	26	16 789	61.1	14.3	32.6
Fort McPherson	1.3	22	15 905	63.5	13.5	24.3
Inuvik	1.1	11	32 426	33.6	26	7.3
Norman Wells	0.1	5	42 369	23	27.3	2.3
Paulatuk	-	-	-	-	-	-
Sachs Harbour	-	-	-	-	-	-
Tsiigehtchic	-	-	-	-	-	-
Tuktoyaktuk	2.1	34	21 670	65.3	22.5	16.3
Tulita	3.5	26	21 673	62.8	26.1	17.4

* % of the labour force ** % total population

Table F 10.

Regression Coefficients and Model Statistics for 1991/95 Pooled Data

Independent Variables	1991/95
Age	
% pop. 0-19	-
% pop. 20-39	-
% pop. 40-59	-
% pop 60-79	0.3685*
% pop. 80+	1.0567*
Model Statistics	
Intercept	-0.0025
R ²	0.7580
Adjusted R ²	0.7312
* $p \leq 0.05$	
- not significant	